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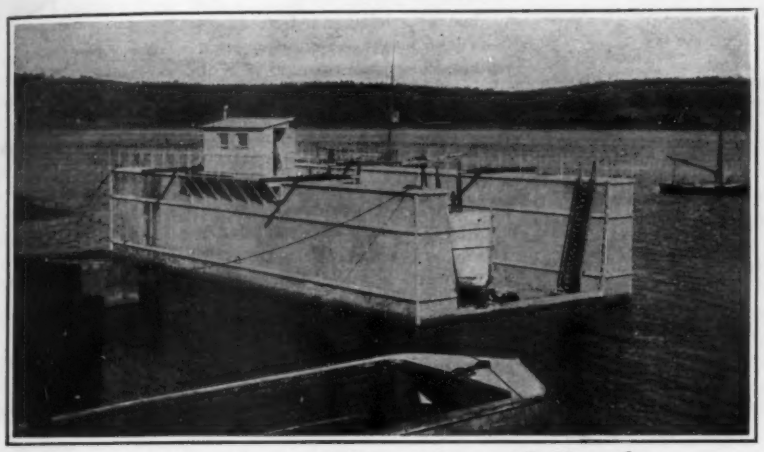
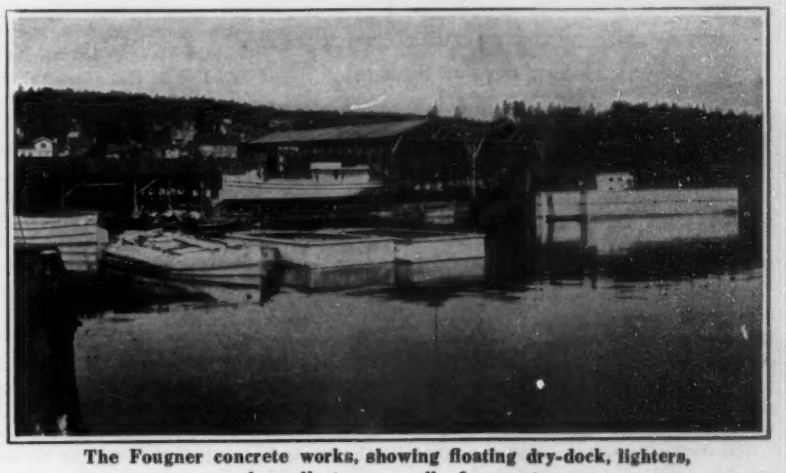


Concrete floating dry-dock in use in a small ship yard in Norway



The Fougner concrete works, showing floating dry-dock, lighters, and small steamer—all of concrete

The Marine Use of Concrete

Ships and Docks of Stone and Some of the Problems They Present

A GOOD deal is being said nowadays about concrete ships; and the tendency appears to be either to assume that the idea is a wholly novel one, or to suppose that it is as simple as A, B, C—that there is nothing involved except the facilities for putting up steel-and-stone on a large scale. Both these points of view are erroneous. The concrete ship is not a brand new thing, neither is it at present an unqualified success under any and all conditions. The fact seems to be that it is in about the same stage as was the automobile in, say, 1890—just upon the verge of establishing itself, but not yet beyond serving as the butt of a good deal of controversy and a good deal of humor.

Like the automobile 25 years ago, however, the concrete ship is overriding controversy and jest alike, and going serenely about the business of establishing itself in its rightful place. What that place will be remains in large measure to be seen; detailed prophecy now would be as premature as it would have been in 1890 with reference to the automobile. But that there really is a place for concrete in naval architecture can no longer be questioned.

Home-made concrete skiffs are an old story—as old as 1870, we believe; concrete lighters, while younger than that, are passing out of their infancy. Even concrete sea-going ships are beginning to make their appearance, as indicated by our recent account of the building of one of 500 tons and the planning of others ranging from 1,600 to 4,000 tons. And, besides being employed for the construction of ships of all classes, there appear to be indications that when normal conditions return ferro-concrete will be used for lighters, floating docks, buoys and other floating objects where weight does not play a very important part.

That this is not at all too roseate a view of the possibilities of this peculiarly modern material will be plain from a glance at the accompanying photographs from Norway, which for the present holds rank as the country of stone ships. The view taken in the Fougner yards—where the "Namsenfjord," which we have already described, was built—is of special interest, since it shows in the same place such a wide range and such a very considerable actual volume of the "stahlbeton," as it is usually called on the other side. When we can assemble several lighters, a small sea-going ship ready for launching, and a fair-sized floating dry-dock, all of concrete, and all of demonstrated serviceability, we must concede that at least this type of construction has passed the period where we can scoff at it with impunity.

At present, however, concrete does not threaten to drive the good steel ship from the seas, even in the minds of its most enthusiastic advocates. For it presents problems which are at best different from those arising in the ordinary ship-yard, and which at the worst are even wholly unique in engineering experience. In the first place, the weight of ferro-concrete detracts from the carrying capacity of sea-going vessels and thus makes it difficult for ferro-concrete vessels to compete with steel vessels in normal times. Nor is experience from ferro-concrete constructions ashore directly applicable to vessels. Fixed structures, as a rule, are only subjected to a load the maximum of which is known, and which acts in one direction; whereas the load to which a vessel may be exposed cannot be calculated by rule, and its direction is constantly varying, especially in a turbulent sea. Under these circumstances, pending fresh experience, the strength of a ferro-concrete vessel must be determined by comparison with that of a steel vessel of the same type and dimensions.

This, however, is a difficult problem. A steel vessel, on account of peculiarities in construction and building, in some directions may have more material than is necessary from general strength considerations, giving thus a misleading comparison. Moreover, several properties of concrete, which it is necessary to determine in order to make fairly reliable comparisons with steel vessels, are not yet sufficiently ascertained. The actual building process of a ferro-concrete ship is such that the quality of the material and the workmanship cannot be controlled with the certainty obtaining for steel vessels. The tensile strength of concrete is very limited. Tensile stresses must, therefore, be carried as far as possible by the reinforcing steel. In a floating structure, however, the concrete cannot be altogether guarded from tensile stresses, which are apt to create small cracks. Such cracks may also arise during the setting of the concrete. On shore they are generally considered to be of minor importance, but it is by no means certain that such cracks may not play a different part in a vessel exposed to varying stresses and the effect of penetrating sea water.

The extent to which these considerations control actual procedures is admirably illustrated by the methods to which Mr. Fougner, builder of the "Namsenfjord," had to resort to prove his first reinforced concrete ship seaworthy. The craft in question was a small lighter, constructed several years ago in the Philippines as a matter of experiment solely, but noticed rather widely in both lay and technical press at the time. The hull was made in the form of three watertight compartments, one fore, one aft, and one amidships. It was of course necessary to know how the vessel would stand up under the strains created by uneven loading and by the uneven support offered to the various parts by a choppy and uneven sea; and the only way in which this could be done was by the good old formula of "try it and see."

So after the appropriate period for setting, etc., the vessel was launched and the central compartment filled with water, while both ends were left entirely empty. This of course, imposed a very considerable bending strain upon the hull; and this strain was assumed to be

(Concluded on page 94)

Concrete ship ready for launching in France

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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

Liberty Motor a Brilliant Success

ONE of the latest and most insidious efforts of enemy propaganda to spread discouragement among the civilian population back of the fighting lines is seen in the persistent rumor that the Liberty motor is a failure, and that the output of airplanes is small and far behind the promised program.

We are in a position to state that not only is each of these statements a deliberate falsehood, but that the motor has exceeded the most optimistic forecast of its performance, both as to horse-power delivered and durability, and that the output of planes is keeping pace with the construction of motors. Both motors and planes are being built at a pace which ensures delivery in 1918 at the rate proposed when the appropriation of $640,000,000 was authorized for their construction.

The work of translating this vast sum, with the greatest possible speed, into a fleet of airplanes and enlisting and training the personnel, so that we may be prepared to launch a great aerial offensive against the enemy in the summer of 1918, is in the hands of the Aircraft Production Board under the Chairmanship of Mr. Coffin, and the Signal Service Corps of the Army under Brigadier-General Squire. The enterprise has been greatly favored by the fact that, in the matter of organization, and in the personality of these two men, it is singularly free from that red tape and professional inertia which has proved so disastrous in some features of our military preparation. The public will be gratified to know that the whole of this vast work, entailing expenditures at the rate of $50,000,000 a month, is swinging along harmoniously and swiftly to its completion at the date assigned.

We have already emphasized the fact that, although the motor is American in type and design, it embodies the best of the accumulated experience of the British, French and Italian aeronautical experts. Our engineers had before them even the designs of the very latest German motors; something that was made possible by captures of enemy machines on the western front. For these reasons it is not surprising that we should have produced a motor which is a distinct advance upon anything as yet turned out on either side of the fighting front.

Since "time is the very essence of this contract" it was obviously desirable to design a standardized motor, which would lend itself to that quantity production which has made possible the enormous output of American factories, and particularly of those devoted to the automobile industry. And in spite of the widespread belief that the building of motors for military airplanes could be done only in such highly specialized individual plants as are found in Europe, the tests (severe and prolonged) to which the Liberty motor has been subjected prove that an equally fine product can be made by our quantity-production methods.

It has been urged that, in view of the rapid improvement in military aircraft, it was inexpedient to tie ourselves up to a single type which however good at the date of its design, might be outbuilt by the time our new fleet was completed. In answer to this it should be noted that the Liberty motor is today well in advance of current practice. Thus, the celebrated Rolls-Royce (according to Major Vincent) which weighs 950 pounds "has never authentically developed more than 360 horse-power"; whereas the Liberty motor develops more than 400 horse-power at 1,625 revolutions, on a total weight of only 800 pounds.

In view of these facts, coupled with the severe tests to which it has been put, it is not surprising to learn that the Allied governments have placed large orders in this country for the new motor.

Not only is the motor "ahead of the game," in respect of its output per weight and total output, but, at a recent meeting of the Society of Automotive Engineers, it was stated by Charles M. Manly, Vice-President of the Society that "the men who are in charge of the Government's Aircraft program have made every possible provision for the improvement of the design with the least possible interference with production." In other words, it will be possible to introduce new features or improvements on later lot orders, "so that the Government will never be tied up with a lot of obsolescent machines in process of manufacture."

Mr. Vincent states that the new motor is to be used on the machines of every type—speed scouts, battle-planes, observation and bombing machines and seaplanes: though these now being built are intended for heavy battle and bombing planes. There are two varieties: one for use at very high altitudes, another for seaplanes operating near sea level.

The tests of endurance have given the following results: The engine designed for altitudes of three or four miles have been run at sea level for eight consecutive hours without showing any weakness. On the other hand the high-altitude engine has been tested in the vacuum chamber of the Bureau of Standards, Washington (where conditions of air pressure and temperature corresponding to an altitude of 35,000 feet can be obtained), for 50 consecutive hours.

At the same meeting Col. V. F. Clark, head of the Section of Experiment and Design of the Army Aviation Service, asserted that if America obtained sufficient aerial superiority to send out a fleet of 500 bombing machines to destroy German lines of communication, there would not be much left of the war.

Undoubtedly; and when the full measure of our manufacturing capacity comes to be applied—as it ultimately will—we shall be in a position to send over the enemy terrain not one, but many raiding fleets of 500 machines each.

Burn Ashes and Use Daylight

IN the present coal stringency any admonition to the general public to economize in the use of coal may well be looked upon as heaping insult upon injury. The following lines are written not for the purpose of urging the starving to economize, but to point out a source of fuel which perchance may have been overlooked.

Some years ago, the public was greatly stirred by the statement that ashes could be used as a fuel in furnaces. It was claimed that, by adding a solution of salt, the ashes could be reconverted into a combustible and heat generating material. Long columns were published in the daily press on this subject, and the public excitement grew, despite the fact that such a claim was contrary to all laws of science and absolutely absurd to any one acquainted with the barest elements of chemistry. Nevertheless, the scheme was tried by hundreds of individuals and was actually found to work. We recall the triumph with which the engineer of our own building invited us down to look at the steam gage which was being kept up to normal on a fuel that he had shovelled from the ash pit. To be sure, the skeptical fireman confided to us, on the side, that he added a few shovelfuls of coal when the engineer was not looking. Nevertheless we were impressed with the fact that there was much heat value going to waste in the ash dump. In most furnaces, particularly in the small ones used in dwellings, coal is very inefficiently burned and the cinders that are ordinarily thrown away contain a great deal of combustible fuel.

It is too bad the ash-burning craze was allowed to wane years ago. Now is the time to have it revived. We feel sure that if every consumer of coal could be prevailed upon to sift his ashes, he would effect a saving that would be of material benefit to the country at large, and at the same time would be doing a great deal toward solving the problems of heating with which he is now confronted. We were told a few weeks ago that half of the coal shortage of this winter could be made up if each householder would save one furnace shovelful of coal per day. Is not this shovelful to be found in the ash pit?

While we are on the subject of coal economies, there is another suggestion which may do its bit toward relieving our present distress. For many years, there has been an agitation to advance the clock during the summer months so as to increase the daylight hours and reduce the hours of artificial light in the normal man's life. Under the stress of the war, European countries have put this scheme into effect with the result that there has been an enormous saving of fuel for lighting purposes. There is a proposition to enact a daylight saving law in this country, to take effect this spring. The value of such a measure is not to be debated.

But why wait until the spring? Why should not our clocks be advanced now? Many offices are using artificial light late in the afternoon, which could well be saved if the clock were advanced so that their closing would come an hour earlier. To be sure, by advancing the clock so early in the season, some lights would have to be burned in the homes during the early rising hours, but it would not offset that now used at the other end of the day, because late afternoon lights are used both in the office and in the home.

Daylight saving can be effected without disturbing business in the least. Let us have it now!

The Problem of Left-handedness

AT least one human being in fifty is left-handed. This is the minimum estimate. Some authorities say four in fifty. W. Franklin Jones, whose investigations we shall refer to later, declares that 4 per cent of the race are born left-handed, but about three-fourths of these are converted by training into more or less imperfect right-handers. On the other hand, about one per cent of the race, though born right-handed, is trained to use the left hand because of accidents to the right. Miss L. G. Smith, from statistics of more than 2,000 school children, found that 4½ per cent of the girls and 5½ per cent of the boys were left-handed. Among the blind, feeble-minded and delinquent the percentage of left-handedness is considerably higher. This doubtless explains the fact that left-handedness itself has come to be looked upon popularly as a defect, notwithstanding the number of left-handed persons who have attained the highest distinction in all lines of achievement.

These figures suffice to show that the question of how to deal with left-handed children is one which arises in countless families, but when the average parent seeks enlightenment on this question he is amazed to find it almost entirely ignored in easily accessible literature.

Professional educators, more than any other class in the community, have been forced to take stock of knowledge concerning left-handedness. A few years ago an interesting symposium on the subject was conducted by W. G. McMullin, principal of the Northeast School of Philadelphia. The results were published in *The Teacher* (Philadelphia) for December, 1914: reveal substantial unanimity among the school authorities of the eastern states to the following effect:

"Left-handedness is a congenital condition, depending upon the superior development of the right cerebral hemisphere, and not the result of an acquired habit. It is extremely doubtful whether a born left-hander can ever acquire as much skill with his right hand as he could with his left. As a matter of convenience, and because the lighting and other arrangements of schoolrooms are designed for right-handed writing, it is advisable to teach young children to write with their right hands, unless their tendency to use the other hand appears to be very strong. The effect is generally to make them ambidextral, rather than to 'cure' them completely of left-handedness. If, however, left-handed writing has already been fully acquired, it is not wise to attempt to change to right-handedness."

This probably represents the consensus of current opinion among those who have made a study of left-handedness. A congenital left-hander can easily acquire enough skill with his right hand to prevent him from being seriously handicapped by the fact that the world has adopted a right-handed mode of doing most of its tasks, that many tools and implements are designed for right-handed people, that custom requires him to shake hands with his right hand, that servants bring food to his left side so that he may help himself with his right hand, etc. In other words, a moderate degree of ambidexterity is an advantage and almost a necessity to the naturally sinistral individual. To attempt, however, to convert a born left-hander into a perfect right-hander is not only an impossible task, but one which generally renders the subject inefficient and often makes him a victim of serious nervous disorders. Dexterity and sinistrality are much more than a question of "handedness." They are intimately connected with the location of the speech centers in the brain, the superiority of the right or left eye, and various other physiological and psychological details. Dr. G. M. Gould writes:

"The attempt to reverse the law is both useless, expensive of life, and in reality impossible. No attempt can be wholly successful; none should; and the partial successes produce cripples and awkwards, if not disease and tragedy. Let the left-handed child alone. Nature is quite as wise as the ignorant meddlers."

The investigations of Prof. W. F. Jones, carried out about ten thousand subjects, show that there is a difference in the relative lengths of the right and left forearms between right-handers and left-handers. He has devised a simple instrument known as the "brachiometer," for measuring the length of the "ulna-plus"—*i. e.*, the distance from the point of the elbow to the first joint of the little finger. If this measurement is longer in the left arm than the right, the subject is naturally left-handed, and *vice versa*. The test is applicable even to new-born infants, and the child should be taught, says Prof. Jones, to use the arm having the longer ulna.

To Our Subscribers

IN the present congested condition of our railroads not only are freight and express goods delayed, but even the mails are greatly disturbed. Consequently the SCIENTIFIC AMERICAN is likely to reach you behind schedule time. Do not be alarmed if your copy is several days overdue. If you have renewed your subscription it will reach you safely in due course. Delays are particularly trying in the case of back numbers which, owing to peculiar postal conditions, often fail to arrive until after the current issues have been received.

Industrial Efficiency

Triplex Glass to Be Made Here.—It is announced from London that a group of New York financiers has acquired the patent rights for the manufacture of a triplex glass for war purposes. At present this glass is used in aviation goggles, automobile windshields, port lights of ships, observation windows, chart covers and so on. The manufacture of this glass in America will begin shortly, the plant for the purpose now nearing completion.

Disabled Soldiers and Sailors as Sub-Station Attendants.—By way of solving the disabled soldier and sailor problem, Great Britain has gone to great lengths in studying and devising occupations suited to those whom the war has treated somewhat harshly. One instance of this is to be found in the twelfth course at the Northampton Polytechnic Institute for giving a preliminary training to disabled soldiers and sailors as sub-station attendants, which has just been completed. A number of students who finished the course are now awaiting vacancies.

Old Motion-Picture Films for New Films.—Manufacturers of raw motion-picture film stock have recently requested their customers to return to them all old and scrap film about their studios and laboratories because of the growing shortage in materials for making the celluloid base. The increasing demand for explosives in which gun-cotton figures has taken away more and more of the celluloid supply of film producers; but, fortunately, it is possible to make use of old films for the celluloid they contain. With millions upon millions of feet of old and scrap film lying about in the various American studios, laboratories and exchanges throughout the country, the film users can no doubt supply much of the needed raw materials.

The Danger from Water Gages.—When water and steam are turned into a water gage, with which all boilers are provided, the pressure at times is great enough to burst the glass and to blow the fragments of glass into the face of the engineer observing the gage. In a recent year in Massachusetts seven men lost the sight of both eyes and one workman that of one eye from the bursting of such gages. This danger has been obviated in many cases by providing the glass column with a protecting shield of brass which covers the glass when turning steam and water into the gage, and which is capable of being rotated to the side when the danger of this act is over and it is necessary to ascertain the registration of the water in the boiler. The New York Central Railroad has installed an admirable model of this device in their works, and no accidents to the eyes have occurred from bursting gages among their many employees since it has been in use.

Why Electrical Workers Should Wear Straw Hats the Year Round.—An engineer suggests in a recent issue of *Safety First* the wearing of straw hats with stiff brims for those employed in and around electrical stations. It seems that the straw hat is far superior to a felt hat from the safety standpoint; for should the head come accidentally in contact with live wires, the rim of the hat or the crown prevents injury and gives the necessary warning. The same holds good when working around steam pipes. In a recent accident, where a man unconsciously came in contact with a 13,000-volt line, due to it being slightly above the line of vision, he would have been protected had he worn a straw instead of a felt hat. Some are apt to ridicule the suggestion of wearing straw hats in zero weather, but it is probable that the need for instruction among this class is very great. If a straw hat lessens the risk of losing one's head, it should be worn regardless of ridicule.

How to Select a Factory Site.—In selecting the site for a new factory several points have to be observed. The position should be on firm and well drained soil, more particularly where high chimneys have to be erected, and the subsoil should be good where heavy weights have to be carried. Otherwise the cost of piling and concrete may very well exceed the cost of the superstructure. Facilities for transport must also be good, canal work being cheap although slow, while railways give the advantage of speed, but at a high cost. In either case the direct loading at the works is to be preferred where possible, as handling and carrying goods from works to loading places becomes very expensive. Public lighting and water services should be within reasonable distance and sewerage should be available if possible. In addition the supply of labor is an important point, there either being housing accommodations handy, or there being rail or street-car accommodations within a short distance. Unless the workers are fresh when they arrive at the plant they cannot do full service, and persons having to walk several miles are not in a fresh and fit condition for work by any means. Another point is to get as near the source of raw materials as possible, since this makes for considerable saving, concludes *The Practical Engineer*. It should always be borne in mind that the raw materials, being the more bulky, cost more for transportation than the finished product.

Science

A New Hydrographical Instrument.—In the *Journal* of the Washington Academy of Sciences for December 19th Mr. A. L. Thuras, of the Bureau of Standards, describes a new and simple instrument for measuring the density of sea water on shipboard. By the use of carefully calibrated bobbins a density measurement of a liquid of known temperature coefficient can be made in less than ten minutes to an accuracy of plus or minus two in the fifth decimal place. The sensitiveness of the instrument, after proper adjustment, is unaffected by the motion of the vessel.

Apple Scald of green and ripe fruit in storage is, according to the U. S. Department of Agriculture, a result of several conditions, including accumulations of carbon dioxide, produced by the stored apples, the lack of air movement in the storage rooms, and the depositing of moisture on the fruit. Investigations recently carried out by Messrs. C. Brooks and J. S. Cooley show that scald can be entirely and easily prevented by an occasional renewal of the air of the storage room. This is a matter of much interest to the apple industry, as scalded fruit, on account of its unsightliness, does not command good prices. It is also very susceptible to certain storage rots, and its flesh is of poorer flavor than that of unscalded fruit.

"Coal Savers" Again.—The present dearth of fuel in Europe has naturally led to renewed activity on the part of promoters of preparations alleged to contribute to the heating power of coal when applied in prescribed doses. According to a consular report from London, various "coal savers" are being extensively advertised in England. In reply to an inquiry as to the value of such preparations, the Director of Fuel Research in Great Brittain declares that, while proprietary substances of this character have been on the market for a long time, there appears to be no scientific evidence in support of the claims made for them. He states that "the nature of the substances makes it highly improbable that they have any affect whatsoever on the combustion of coal or other fuels when they are used in the quantities prescribed.

Venezuelan Balata.—The way in which Venezuela is wasting her resources in the valuable gum known as balata is described at some length in a recent consular report. A good account of this gum will be found in Thorpe's "Dictionary of Applied Chemistry." It is obtained by coagulating the latex of a large forest tree of northern South America and the West Indies, *Mimusops globosa* Gaert., known in the vernacular as the *purguo*, and is the best natural substitute for gutta percha, being used especially in the manufacture of belting and the covers of golf balls. In former years it constituted the most important export of Venezuela with the exception of coffee and cocoa. While in British and Dutch Guiana, where it is also produced on a large scale, the felling of the purguo trees is probihited and the trees survive the process of tapping, in Venezuela it is the custom to cut down the trees in order to collect the sap. According to the estimate of an official commission, no less than 36,000,000 purguo trees have been destroyed by collectors during the last ten years, resulting in a loss to the nation of more than half a billion dollars. The tree is of slow growth, requiring ten years to reach a productive stage and 30 years or more for full development. The trees are always much scattered, and land bearing 16 to the acre is considered rich.

Brushwood and Steel Slag for Sewage Filters.—Some interesting experiments are reported by G. Phelps in the *Canadian Engineer* on the use of brushwood and also on the use of graded steel slag as filter media for sewage. After two months the brushwood became thickly coated with gray slime and a very satisfactory effluent was obtained. From that time on the flow of the filter increased up to a rate averaging 7,250,000 gallons per acre per day. The best material was found to be witch-hazel, but almost any kind of brush is said to be suitable, provided no dead wood is used. It should be cut in the autumn or early spring, when there are no leaves on it. The slag filter was started with a rate of 1,250,000 gallons per acre per day and worked up to 2,500,000 in six months. "The rate was increased for a short time to 3,000,000, but this resulted in clogging and ponding on the surface; and the rate had consequently to be reduced. The effluent from this filter has always been satisfactory, but its capacity is limited to about 2,000,000 gallons per acre per day, the rate at which the sewage will pass through without clogging." Analyses show that nitrates are not formed in the brushwood so readily as in the slag filter, probably because of the greater rapidity with which the sewage passes through the brushwood. The open nature of the brush allows good aeration. Brushwood filters should be made at least 7 feet deep, if possible, and made up to this depth again after 12 or 18 months, when considerable shrinkage will have occurred. Brushwood appears to be especially suitable as a medium for inducing the slimy growth characteristic of sewage filters; in this respect it presents a marked contrast to stone and slag.

Automobile Notes

Oily Brakes.—A note in a recent issue suggested a method for draining the oil away from the outer end of the axle casing, to prevent it reaching the brakes. This suggestion was derived from an English source, where it was stated that the plan had been successfully tried out. A correspondent takes issue with the statement, claiming that due to the crown of the road, and other conditions, the outer end of the casing is frequently so much lower than the bowl of the housing that the oil would flow to the brake, rather than be drained from it, as intended. Moreover, he claims that the fitting could not be maintained in place, but would loosen, or break off, and that properly placed felt washers are the best remedy. This criticism seems to be well founded; but the root of the trouble would appear to be an excessive and unnecessary quantity of oil in the differential housing.

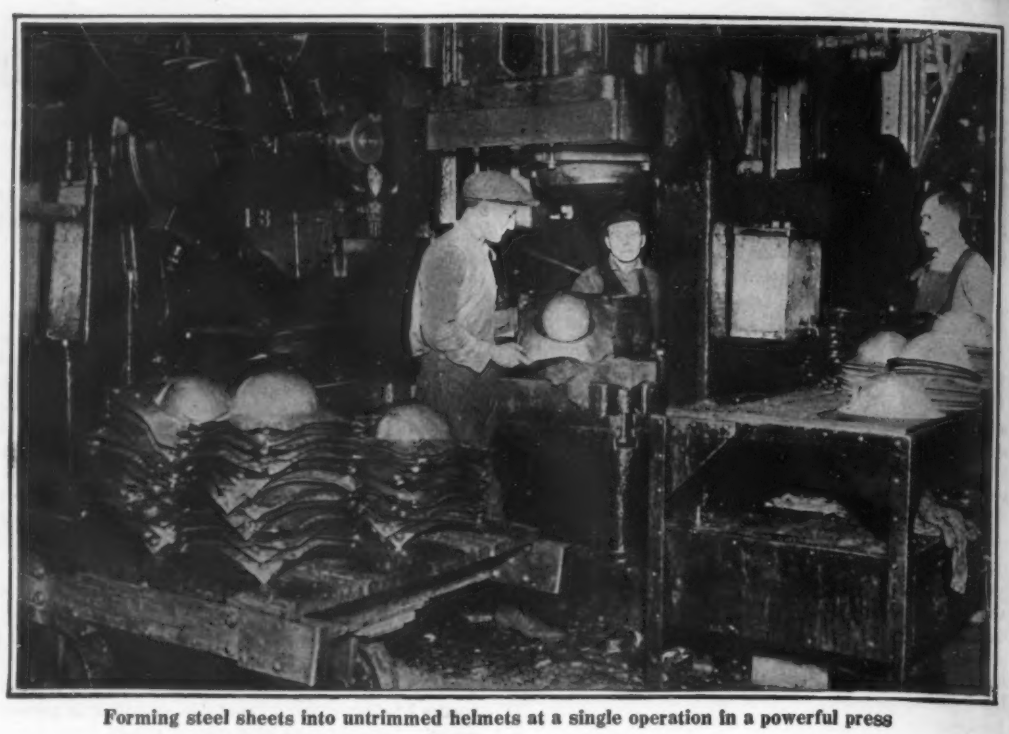
Keeping the Engine Warm.—In cold weather it is not necessary, nor desirable, to have as great a current of air through the radiator as in the summer; and while some of the higher priced cars are provided with convenient devices for modifying the draft, most owners resort to a blanket thrown over the front, or to one of the numerous "cosies" that are on the market. A simple and convenient suggestion in this line that has been made is to mount a spring roller curtain on the frame, in front of the radiator and to draw it up over the openings as conditions require. It is held in position by a string secured to the filler cap, or the string can be led to the dash, so that the regulation may be made while the car is running. Of course any suitable material can be employed for the curtain, such as light canvas or one of the durable waterproof fabrics.

Selling Trucks.—Comment is frequently heard on the relatively small proportion of motor trucks being used in our large cities, and surprise is expressed that such conditions should exist in the face of the overwhelming evidence of the superiority and utility of this means of transportation. A plausible explanation was given at a recent meeting of the Society of Automotive Engineers by a prominent official of a large manufacturing company, as follows: "The sale of a motor truck is too often effected by a bombastic and ill-informed salesman who knows little or nothing of his prospect's needs. The buyer in most instances is a good business man but does not have the experience or training to judge properly the merits of the machine offered. In fact, a considerable part of the merchandising end of the motor truck industry is deficient in the elements that make for satisfaction to the buyer and seller." This is the application of pleasure car methods to a commercial proposition.

Ignition and Carburetion.—One great object sought by makers of ignition apparatus is to produce as large and as hot a spark as possible, in order that the ignition of the charge may be effected at the point in the stroke where the most effective result will be secured. This proposition is based on the very imperfect condition of the mixture that now prevails, that is a mixture consisting of the air and a small percentage of vaporized fuel that carries with it a large proportion of the fuel in the form of an unvaporized spray. If, instead of this the entire charge of fuel was entirely in the form of a true gas, or vapor, the ignition would be so much easier to effect that a small, light and inexpensive ignition apparatus would amply suffice instead of the powerful and costly devices that are now being sought. The most needed improvement in internal combustion motors today is in an entirely different direction, and that is a carbureter that will furnish the charge in the form of a true gas that can instantly be ignited, and completely consumed. Such a carbureter would increase the power of the engine, and at the same time consume much less fuel.

Roads of the Future.—While we have a very considerable mileage of so-called good roads in this country, it is an undoubted fact that the greater portion are not of a character to sustain successfully the heavy motor truck traffic that is now appearing on them, and which will certainly increase rapidly in the near future. To meet the new conditions steps should be at once taken to formulate a systematic plan not only to provide new roads, adapted to the new traffic, but to maintain them in operative condition. Provision should also be made for the rebuilding of much of the older mileage. What the nature of the construction of these new roads shall be is a matter for the engineers to solve, but there is no question but that there must be better drainage, better material and very much heavier foundations than have ordinarily prevailed in the past, especially as with smooth road surface the speed of these trucks is sure to be greatly increased. England has had her experience in this matter, for, what with heavy traffic added to lack of maintenance, on account of war necessities, there is hardly a main road in the country that is not utterly worn out, although they have been accustomed to build much more heavily than we have in the United States.

Testing steel plates by forming a hump in each corner



Forming steel sheets into untrimmed helmets at a single operation in a powerful press

Our Most Fashionable Hat for 1918

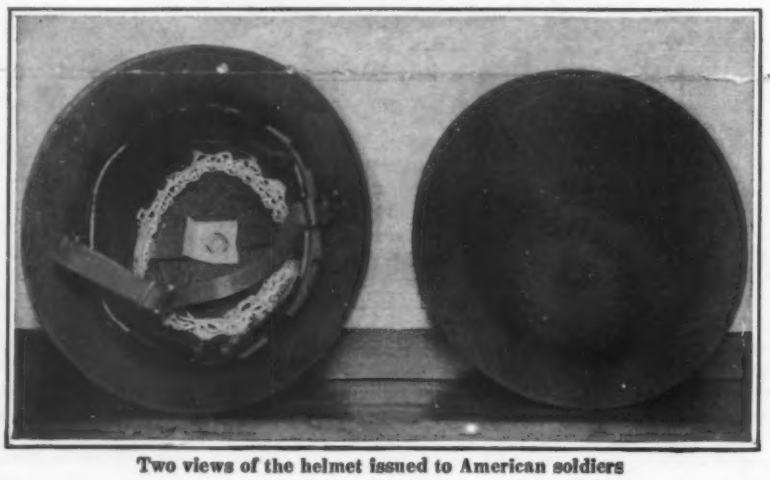
Turning Out Millions of Bullet-Proof Steel Helmets for Our Soldiers

Photographs Copyrighted by Underwood & Underwood

AMONG other things modern warfare has decreed that the only kind of hat for soldiers on the firing line is a steel one. Allies and Germans alike did not know that fashions in military hats had changed until the war was several months old; for it was only after they had studied their long casualty lists that they came to realize that four-fifths of the cases were head wounds. So steel head coverings came into vogue. First the French introduced their shapely steel helmet; then came the British with their inverted soup-plate helmet, shortly followed by the Germans, Italians, Serbians, Roumanians and Austrians.

Our soldiers, like their comrades-in-arms and the common foe, are to be equipped with steel helmets while in the war zone. Our choice has fallen on the inverted soup-dish helmet of the British in preference to the French *casque* or the German coal-scuttle helmet. To the layman our helmet and the British helmet are identical; but if they are placed side by side and studied in detail it soon becomes evident that they are somewhat different. Still, the difference is mainly in the contour and the slope of the sides, and in the main the principle is the same. However, we have been particularly fortunate in our steel selection; for penetration tests have proved our helmet to be superior to that of our British ally. Our helmets contain no cracks or flaws. In short, we have a helmet which, to all intents and purposes, is second to none in point of efficiency.

The manufacture of steel helmets is largely a matter of stamping and punching. And with our tremendous plants for stamping and punching anything from a small strip to motor truck bodies, we have tackled the manufacture of millions of steel helmets without delay. From first to last the various steps in the manufacture of these helmets lend themselves most admirably to our American quantity-production methods; so much so, indeed, that the engineers charged with the work have taken keen delight in perfecting a system whereby thousands of them can be turned out every day with a minimum of labor. With some this work has been a hobby.



Two views of the helmet issued to American soldiers

The steel sheets for making our helmets are furnished to the various plants engaged in helmet manufacture by the United States Government. All cuttings and other wastage are returned to the Government by the plants as a measure of war economy. Each sheet measures about a foot square by one-sixteenth of an inch thick when ready for the interesting manufacturing process.

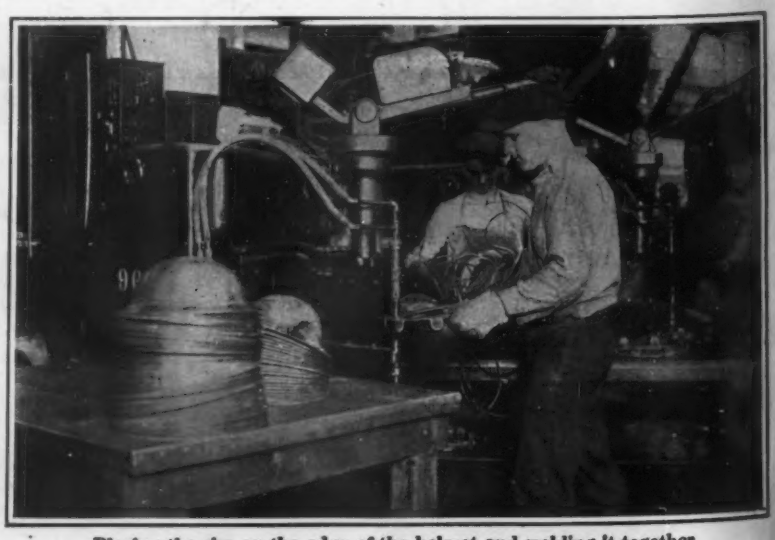
Now in theory every sheet is as good as the next, or at least it should be. But in practice this is not the case. One sheet out of every twenty-five, fifty or one hundred may have a hidden flaw which remains undetected until the sheet is subjected to the great pressure necessary to form the helmet. Then the flaw is detected and the helmet in the embryo state must be discarded. Not only is the sheet wasted in such a case, but all the manufacturing expenses up to that point must be charged against the defective steel.

American efficiency calls for a helmet from every piece of steel that starts through the plant. Hence the present practice is to test each sheet before it finds its way to the stamping presses. The test consists merely of forming a small hump—in reality a small helmet—at each corner of the sheet; in other words, this is nothing more than subjecting a small section of the material to the same strain which the center section will have to bear in the huge forming presses. These small humps serve to bring out any flaws that may exist in the sheet, and these are soon detected by inspectors who pass on the sheets.

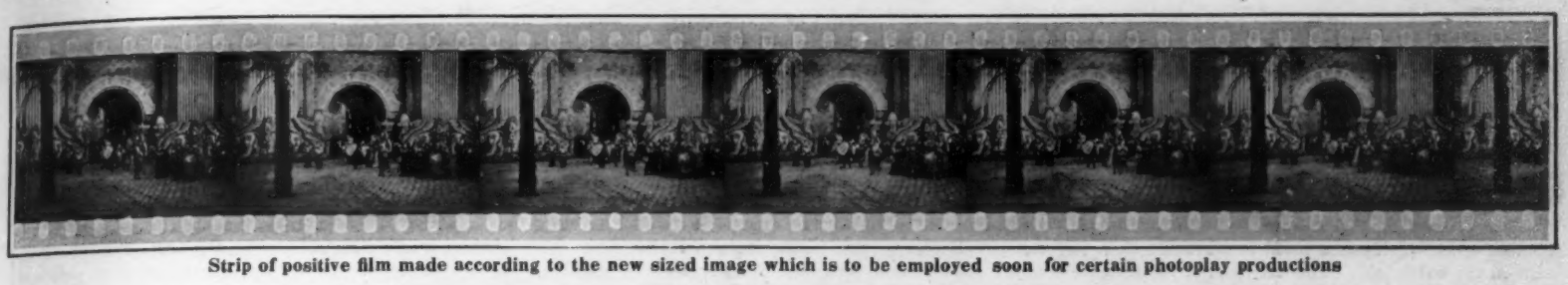
Sheets with four perfect humps now make their way to the forming press. Each sheet is placed in turn between the male and female dies of a huge press. The operator manipulates a lever and the dies squeeze the sheet into shape to the accompaniment of an unearthly shriek. Covered with heavy oil the sheet, now formed into the dome of the helmet but still carrying the square sides and humps in the corners, emerges an instant later

(*Concluded on page 94*)

Trimming the rough formed helmets in a heavy-duty stamping press



Placing the rim on the edge of the helmet and welding it together



Strip of positive film made according to the new sized image which is to be employed soon for certain photoplay productions

Projecting Larger Pictures with the Standard Motion-Picture Film

HISTORY is about to repeat itself in the motion-picture industry. From an image measuring 2 by 2½ inches the industry went to a standard image measuring ¾ by 1 inch. For ten years the standard image persisted. Presently, however, the size of the image is about to be enlarged in the case of certain productions; but this time the standard sized film stock with its perforations is being retained, so that the original reasons for adopting it continue to be respected.

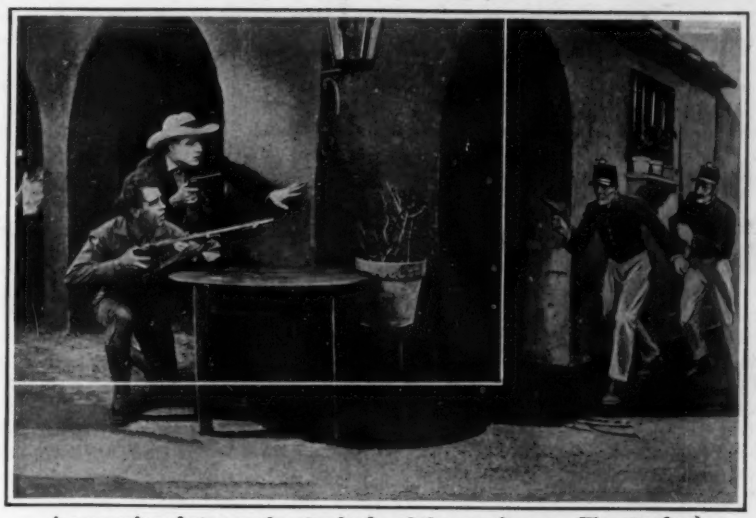
The new form of film moves horizontally instead of vertically, and its images are twice as large as the existing standard, or 1 by 1½ inches. In other words, using present-day film two separate "frames" or images are merged into one picture which is accordingly as high as the ordinary image is wide, and twice as wide as the ordinary image is high. The new image gives a picture on the screen of a different proportion than that now shown; it is in the proportion of four to six instead of the three to four of present films. The perforations of the new film are identical to those now in universal use, and all the advantages of standard films, such as tensile strength and the value of standardization in laboratory work, shipping and handling, are retained.

Mechanically, the new process is most interesting. The camera, as will be noted in one of the accompanying illustrations, operates in the horizontal plane in contradistinction to the upright position of the conventional type. Standard lenses are employed with all their inherent advantages, such as high speed and great depth of focus.

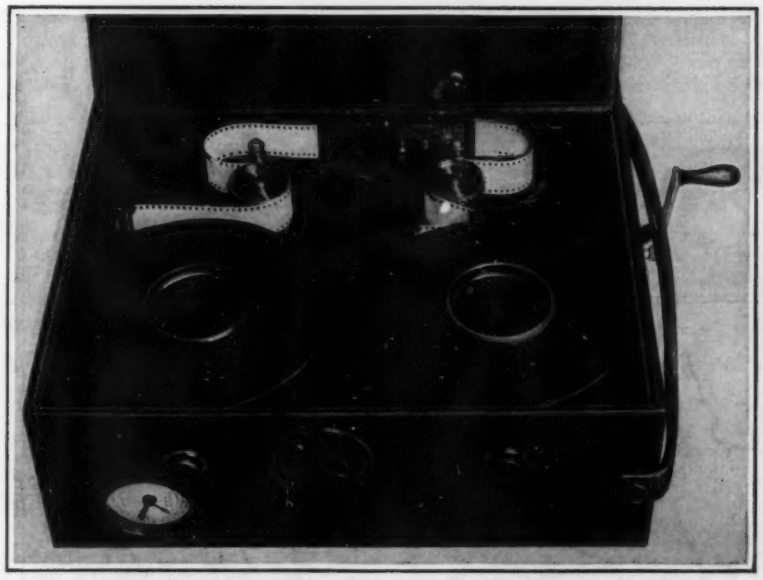
For projecting the new film an improved type of projector is employed. Obviously, as in the case of the camera this projector handles the film in the horizontal plane. It is said that a flickerless picture has been attained through simplification of parts on the projector and through the introduction of new members. The mechanism for handling the film not only moves the film twice as fast as the present one-foot-per-second movement, but is claimed to damage the film less than present projectors. As a result the film, although twice as long as the usual film, is less expensive in the final auditing because the positive prints last more than twice as long as the latter. There are a number of other interesting features concerning the mechanical side of the new pictures, but at present these cannot be divulged.

From a director's standpoint the new film is a tremendous step forward in the art. Not only is the new image of more attractive proportions for scenic effects, but, while still keeping the actors the same size as formerly, it is possible to include more of the stage. Thus a scene can be shown in which the actors enter from "off stage," and two sides of a wall or a turn of a corner can be shown in the same picture without sacrificing detail.

To appreciate fully the advantages of the larger screen picture it is necessary to refer for a moment to the present limited image. Because of the small size of the scene it is generally necessary to make use of what is known as the "cut-back," which is the device for representing simultaneous action at different places or when it cannot be included in one scene because of the limitations of the camera. Thus, in the case of a scene such as that shown in one of the accompanying illustrations, under the existing system the "cut-back" is necessary in order to show first the two men waiting for the soldiers, and then the two soldiers coming up the side street—flashing from one scene to the other and back again. True, the entire scene can be included in one picture even with the present film, but this means reducing the size of the figures in order to take in the full action, which, obviously, would make a poor picture. With the new system, however, the "cut-back" is eliminated because the entire scene can be taken in at one time while maintaining photographic standards. Incidentally, this makes for better technique in the photoplay, for at best the "cut-back" is a rather crude device.



A comparison between the standard and the new image. The standard picture is enclosed within the white line



Camera employed in making the new horizontal motion-picture film

The average photoplay is burdened with necessary "cut-backs" which often serve either to confuse the audience or draw out the story until it begins to lose interest. It interferes seriously with the continuity of the theme in many cases; but owing to camera limitations it is forced on motion-picture directors. In the new film the "cut-back" is absolutely unnecessary, and only in instances where its use makes for added suspense or greater force in the photoplay, need it be employed. Indeed, the very fact that this device with its consequent footage is eliminated in the new film, makes for a considerable reduction in the total length.

In large mob scenes where hundreds or even thousands of actors appear the new film has marked advantages. With an area twice that of the ordinary image it is capable of covering more scenery without reducing the size of each character; and as already brought out, because of its greater width it is better suited to outdoor views. All in all, the new film gives the director a larger stage to work on and a freer hand with his actors who no longer are limited to a ten or fifteen-foot stage. On the screen the new pictures, instead of appearing as a window through which a production is being viewed, will have the appearance of a stage production as seen from a theater seat.

To produce simultaneously standard and new films of various photoplays is the plan of Mr. W. W. Hodkinson, a film man of New York.

Snow Storms Disrupt Railroad Schedules

WITHIN the past few weeks many of our railroads have found it utterly impossible to maintain their customary schedules, owing to extreme weather conditions. Heavy snow storms have covered tracks under thick blankets of snow, while masses of ice have played havoc with signaling systems and switches and water supplies. The present coal famine is in large measure due to the severe snowstorms.

Typical of the blizzards experienced recently in and about Chicago is the accompanying illustration. It shows two locomotives employed to breast a storm and bring in a train which, even with the added hauling power, was 12 hours late. When the locomotives pulled into the Grand Central Station of the Soo line the foremost was covered with several tons of snow and ice picked up on this strenuous run from Minneapolis to the Windy City.

And still the question is asked: Why should the snow delay trains so?

Copyright, International Film Service

Covered with tons of snow and ice, these two locomotives hauled an ordinary train from Minneapolis to Chicago during the recent blizzard

Strategic Moves of the War, January 17, 1918

By Our Military Expert

THE weeks just passed have been devoted more to peace maneuvers and statements by the leading authorities of both the Central and Entente Allies as to the terms upon which peace could be discussed than to results on the battlefield. The war aims of the Entente have been quite clearly set forth by the highest English authority and also more definitely by our own President. The latter's statements as regards these have been clear and convincing; while they were rather war than peace aims, they have been universally accepted throughout our country and leave to us but one course to follow—an energetic and concentrated effort for the war's continuance until Germany is defeated and until the Hohenzollern and Hapsburg influences have been removed from the world's progress.

The principal military interest is still centered on the Italian front, where attempts by the Austro-Germans to cross the Piave River have been frustrated, while the Italians have driven back across the river the hostile troops holding the bridgehead at Zenson, on the middle Piave. In the mountain regions the operations have been practically confined to heavy artillery fire and bombardments. The severe weather conditions are proving of unusual assistance to the Italians on their northern front. The mountain passes are choked with snow and the enemy's further advance is entirely checked. Trains are also held up in the Val Sugana toward Trent and supplies are thus temporarily cut off from the Austro-German armies. Unless the storms stop at an early date, the results must be disastrous to the invaders and may even imperil their existence. It is expected that strong counter efforts will be made by the British, French and Italian forces before the enemy's troops can be supplied and reinforced. This whole front is now witnessing the most perfect coöperation of the Allied air and artillery services; the supreme council is directing military operations so that the maximum results are being obtained with the minimum of effort. The effect of the blocking of the mountain passes has already been foretold in this review; under present conditions a continuance of storms and cold weather would certainly be most serious for the enemy's forces shut in the mountains and unable to get food and ammunition.

Although the mountain front has been comparatively inactive, except for air raids upon unfortified Italian towns south of the Alps and corresponding reprisals by Italian planes upon ammunition dumps and moving columns, the British have made successful sallies across the upper Piave, bringing back prisoners and guns. These frequent and unexpected moves lead to the belief that a counter-offensive against the Austro-German troops is in preparation by striking on their left flank for the purpose of forcing them to withdraw along their entire front. The Allied Italians, British and French are now where they can force the fighting from the Alps to the Adriatic; for the northern front need not now be considered. The invaders are here in a serious position as the recent heavy snows have so filled up the mountain roads and passes that communications have been almost entirely cut off. Until they can get ample supplies of food and ammunition over the railroads in rear of their lines, not only will they be unable to conduct offensive operations but they may be seriously threatened with starvation. It should be recalled that the enemy's northern front can be supplied by rail only from Trent, the great military supply depot, in the valley of the Adige; the latter in turn can be supplied only from Innsbruck and Botzen due north or from the longer route of the Carnic Alps from Villach via Brunneck and Mühlbach to Botzen and the south.

It would be folly for the Austro-Germans to attempt to make use of the mountain passes where snow lies from three to ten feet in depth and where avalanches are of daily and even hourly occurrence. Their position on this northern front is such that the Italian commander has a most excellent opportunity for taking the offensive on the Piave. If with the aid of the British and French reinforcements he could turn the Austro-German left flank before reinforcements could be brought either to the northern or Piave fronts, he could compel the invaders to withdraw from their present positions and could do much to regain the ground lost in the retreat from the Isonzo and to reëstablish his own lines so that they would not be threatened as at present. Everything points now to such a move in contemplation and it may take place very soon. The recent French advance at Monte Tomba has shown what would be the effect of a break in the Austro-German lines on the upper Piave. At any rate winter conditions will have little or no effect on the line of the Piave in the Venetian plains.

On the contrary, while heavy bombardments have been reported all along the northern front from the Asiago plateau to the Monte Tomba region near the upper Piave, snow and bad weather restrain fighting activity to a minimum. But the Entente Allies are also evidently not losing sight at any time of the Italian battlefield, as it may be here that a decision of the war might be reached. It was evidently intended when the retreat from the Isonzo began, to retire to the line of the Adige, the line of the Piave, like that of the Tagliamento and Livenza, being regarded as only provisional; however, it has now unexpectedly become a definite line that must be held at all costs and for this purpose Monte Grappa and the mass of hills between the Piave and Brenta have become a bulwark for the defense and an absolute necessity for a successful opposition to the Austro-Germans. Such a defense would go far to strengthen the hands of the patriots who are doing their best behind the lines to counteract the efforts of those who would betray their country as has been the case in Russia. For this reason the defense of Venice has become an essential; not only is it the well-known seat of art both ancient and modern, but it is only now that its military and naval importance stands out. As Venice goes, so goes the control of the Adriatic; its loss would be a blow to Italian pride and prestige from which the country would hardly recover during the present struggle, for the Central Allies would be then masters of the entire Italian peninsula.

The present outlook would indicate a strong offensive on this Italian front when spring opens. Regarding the massing of troops for such a movement on the western front, it must be recalled that heretofore, when a strong German attack against a weak front, as in Rumania, was in contemplation, it was always preceded by rumors of concentrations on the western fronts, thus causing the Entente Allies to hold in reserve large bodies of troops that could have been utilized elsewhere to great advantage. In her drives Germany has always attempted to put the country attacked out of the running so far as the war was concerned; she has also shown in her drives on the western front the impossibility of obtaining this object against the British and French lines there. She is now hoping to eliminate Italy by her recent offensive; but everything points to a failure both politically and in a military way; she may continue her efforts here by holding up on the western front—a method that would seem to be the most advantageous for her under present conditions as she must long ago have given up all idea of any separate peace with Italy.

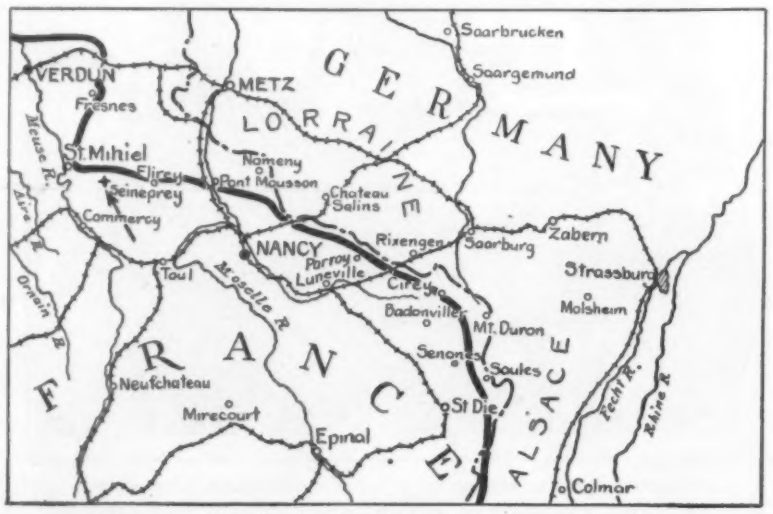
The severe weather has extended not only along the Alps but even into northern, central and southern France. It has hindered military operations which seem at present to be limited simply to raids, aerial and on the ground. Despite the advantages of continued operations in Italy the probability of the Germans taking a vigorous offensive here can be well considered. There are two factors leading to such a probability—the steady flow of German reinforcements from the Russian front and the fact that our own country is not yet ready to supply enough men to take any considerable part in military operations.

Recent attempts at partial offensives lead to the belief that there is being gradually developed a new distribution of forces on the German lines: but so far this distribution has not reached a scale sufficient to justify operations on a large scale on the enemy's part. The Germans are still a long way from having superior numbers on this front; but the relative strength may be soon so altered as to preclude offensive movements on the part of the allied commanders. If a great superiority in numbers is obtained by the Germans, such an advantage would undoubtedly lead to offensive operations on a wide front. The Allies, due to gains of positions during the past year, are much better prepared for defense than ever before, though temporary losses of positions and of men must be expected from energetic assaults on the part of the enemy.

On the western front there is little to record beyond the weather, for, except for occasional raids from one side or the other, there is little gun fire—less probably than at any time since the advance began last spring. The lull in operations is giving the troops on both sides an opportunity to rest and to recover from the effects of months of nerve-racking strain of constant fighting. Heavy snow storms have also added their complement to the enforced inaction; these storms have been supplemented by heavy frosts and cold weather. There are at present many signs of the weather breaking and of a great thaw that will convert all the low countries into seas of mud; all the ground over which there might be fighting will be quagmires and slush and all the roads will be made impassable for wheeled transportation. Only those who have seen this country in winter can form any conception of what a thaw means here and of the conditions that prevail during its continuance. For that reason it can be expected that here at least no great military operations will take place in January and even in February; March next will no doubt see the beginning of battles as spring advances and as the ground dries.

On the higher grounds in France heavy snows have covered the country and have so far forestalled the strong German offensive that has so long been looked for since the Russian collapse. When that time comes, it will be seen whether the German soldiers will be willing to make the sacrifices entailed in massed assaults as at Verdun. Such information as has come to hand leads to the belief that important operations are being prepared and that they may be counted upon to call upon the British and French troops for every effort to drive back their opponents. The German offensive, if it comes, will be the greatest card of the Central Allies; should it fail, it may also be their last; for it can be scarcely expected that any armies can stand the losses of a second Verdun. The Entente Allies are also making their plans and preparations and feel confident of again showing the superiority of their troops over those of the enemy, as was the case at Verdun and on the Chemin-des-Dames by the French and on the Somme and in Flanders by the British. Heavy artillery fire has prevailed on the lines from the North Sea to Switzerland, and spasmodic thrusts and raids have been the order of the day. Just at present hostile activity is greatest in the vicinity of Lens and Cambrai indicating that when the great attack comes, it will be in the sectors near one or both towns. There was recently a violent thrust made by the French on the Meuser heights east of the German salient of St. Mihiel. It does not appear that they had any intention of retaining the positions captured; the move was apparently only for the purpose of obtaining information concerning the long heralded plans of a German offensive.

Despite the accepted agreements with the Bolsheviki in control in Russia regarding the movement of troops from the Russian front, it seems highly probable that removals of troops from the east to the west fronts by the Germans have continued for some time and are still being carried out. Many details are being learned from prisoners and other sources, as regards daily movements and numbers. Up to the end of November it has been computed that the divisions on the Russian front had lost to the west at least seventy-five thousand picked men and those among the best of their class. Such an addition would put off sending recruits into active fighting lines and would permit the eastern front to become a training school for the novices—an item of peculiar advantage to Germaty just now. This all shows that the agreement with Russia has been absolutely broken from its inception—in other words, it had become one more "scrap of paper." Whatever may happen on this front in the coming campaign, it must be remembered that during the past year wherever an advance has been begun both the British and French have pushed steadily ahead. Despite temporary checks the gains of both have been cumulative and the Germans have been forced to give way during the operations. The Entente Allies have every reason to be satisfied with their progress on this front during the past year.



The region below Verdun in which early action may take place

Columbia University an Armed Camp

Four Thousand Officers of Reserve to enter Government Military School of Cinematography

COLUMBIA University took on something of the appearance of an armed camp after the middle of January, for then began to arrive, in squads of one hundred at a time, four thousand officers of the Reserves to learn the most advanced methods of aerial and land photography, and cinema operation.

The United States Government is actively pushing its campaign of education of the masses and its war photographic work, and has accepted the offer of Columbia to make use of its resources for teaching military photography in all its branches. The school, however, is to be managed solely by the Government, which determines, also, the personnel of both students and instructors.

Only persons who understand the difficulty that has been experienced in projecting photographs that have been filmed by different makes of moving picture cameras can appreciate the object of the Government in assembling four thousand men to study cinematography, as well as "still" photography, at Columbia. The Government has overcome the principal difficulty in perfect cinema operation by standardizing everything connected with its cinema work and wants these officers to become accustomed to the Government equipment, so that pictures taken by different cinematographers may be projected without a flaw upon the same screen. That the entire work may run with smooth precision upon the screen, men will learn at the University not only how to take moving pictures, but how to develop, cut up and assemble films, and how to project them in theatre or camp. Not the least important lesson will be how to pack and ship films, so that those taken by a cinematographer in the front line trenches may be safely transported for development in the rear.

The scope of the work is such that the University has had to provide a projection room, laboratory, work rooms and lecture halls on the campus, as well as dark rooms, and the customary appliances necessary for the study of still photography. These demands have resulted in a scattering of Government work through different buildings, with the basement of Havemeyer Hall as main instruction room. This spacious floor has a fine north exposure which supplies ideal light for photography, and Monday, January the fourteenth, saw the inception of this first Government school of military cinematography in America, and the conversion of the seat of learning into an army post.

The post is limited to the Government's activities, and embraces an administrative force of 125 officers. When detachments of students arrive from their respective camps, they will find themselves under military discipline no less than before, with the gay temptations of Broadway nearer in distance but not in attainment. These men have been drawn from various regiments because they have some knowledge of photography, and instructors have been engaged to develop this knowledge for military purposes.

Some idea of the Government's appreciation of camera work as a war measure may be gathered from the fact that 5,000 war airplanes have been and are being built with camera observation equipments, and men will be trained to take still pictures as the airship volplanes to a height of 1,400 feet above the earth, an average height proved best for picture taking. This altitude, of course, subjects both pilot and cinematographer to the risk of being hit by aerial gunfire; so to offset this danger, the men go up to secure photographs of an enemy country about sundown. Very little light is needed for taking pictures from a high altitude, and when the pilot volplanes downward to the required level in the air he trusts to good fortune and the dim light to assist him in making a safe as well as rapid escape.

In their moving picture propaganda the aim of the Government is two-fold: to educate the American public in what the Nation is doing with our soldiers abroad and to instill in the minds of soldiers in camps where the films will be exhibited, an even greater patriotism.

At Columbia the war photography work is in charge of Captain J. Sears, assisted by Lieutenant Carl Gregory and five or six aides, with offices in the Library buiding. The University has, indeed, without fanfare of bugle or beat of drum, become an armed camp, an established army post with 125 officers in charge.

A plan is under way to add a School of Navigation, to train officers for our growing merchant marine, with Professor Harold Jacoby of the astronomical Department, at the head of it, and it is rumored that an Aviation School is soon to follow.

Up to the present time passers-by have become accustomed to seeing 200 marines and blue-jackets from the School of Engineering drill in the North Court, and some 350 men in khaki drill at night by searchlight on the Athletic Field; but only now has Columbia become an army post and taken on a military aspect. The military students in the United States School of Cinematography will find their routine of camp life maintained by drills in South Field, and such regulations as prevail in barracks. In this case the barracks is located in the main floor of one of the University buildings, and the student-officers police their own quarters. The posting of sentries has been decided upon by officers of this new army post, in consultation with the Superintendent of Buildings and Grounds, and the patrol of these has caused Morningside Heights, accustomed to the sight of drills among students, to open their eyes and realize that one of the oldest seats of learning in the country is the most advanced army post in America.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Farm Machinery in the Corn Belt

To the Editor of the SCIENTIFIC AMERICAN:

I read with a great deal of interest Mr. Dahl's article entitled "Mobilizing the Farm Machinery," and as a Corn Belt farmer, I would like to call attention to a few points which a casual reader might misapprehend and in which the writer unwittingly generalized too much.

I agree with him that the modern farmer should use his head as much as possible but elbow grease is still a prime constituent of farming.

In the West on the great bonanza farms the tractor is all the go, but on the high producing farms of the Corn Belt proper where most of the food of the United States is produced the tractor is not used generally. Why? Because they are just emerging from the experimental stage. There are several makes of tractors that appear to do pretty well on the 120 to 240 acre farm, but they are not yet standardized like other farm machinery or the automobile. The day of the tractor is coming but dawn is not noon time. The wise man lets the other man make the costly experiments.

As to reaping and thrashing at the same time that is possible on the Pacific Coast, but not in the Mississippi Valley where winds and rains would beat the dead ripe grain so flat on the ground that no binder could catch it, and half, or more, would be flailed out anyway.

A riding corn cultivator does not take all the work out of cultivating and on hilly ground the farmer has to use the walker. The vast majority of our corn is husked by hand. Hauling corn fodder is one of the hardest jobs on the farm. Ask any farm hand what he thinks of hauling corn fodder. When a man shells corn he practically always hauls direct to the elevator. He calls in the neighbors to haul for him and to help scoop the corn into the conveyor to the sheller. Mr. Dahl has evidently never scooped corn into the conveyor all day.

He mentions the tractor again pulling a powerful battery of plows or a powerful tractor it doesn't matter which. That tractor could hardly turn around in a 40-acre field which is most common in the corn belt.

There are several other points I will pass over. It is true that we have many labor-saving machines, but we have not reached the millenium he has described. The farmer today has to work as continuously as formerly because he has to produce so much more to maintain his standard of living. The farmer of fifty years ago had just as much leisure as the farmer of today and I believe the past generations were just as happy.

Buchanan, Ia. CLIFTON EMRICH.

Esperanto Facts

To the Editor of the SCIENTIFIC AMERICAN:

Your editorial of November 17th, 1917, "Science and the International Language Question," shows some lack of acquaintance with facts, and of appreciation of the merits of Esperanto as an auxiliary language. You say, "Esperanto, before the war, was on the wane." This was far from being the case. I first became acquainted effectively with Esperanto in the spring of 1914, and have watched its growth since. New classes are being formed constantly in many parts of the world, as recorded in the official organ of the Universal Esperanto Association. You mention reports that the study is popular in the military prison camps. It is also spreading in commercial circles, and is in increasing use in actual commerce, as well as in the gathering and dissemination of information upon many subjects. Aside from any question of the merits of the language in itself, imagine the benefits of such an international association as now exists, wherein the language is represented by a consul or delegate in the principal cities, and many smaller ones, throughout the world, and, provided communications be made in the language, and actual expenses be prepaid, without fees, information on subjects generally is obtained and furnished to members (and the annual membership fee is only 50 cents for individuals, and $2.50 for firms). Keys are already published in nearly a dozen languages, giving Esperanto words (nearly two thousand of them) with translation into the language in hand, and a sufficient grammar to enable any person to make the application, and these keys are sold at a cent each, in quantities, or two cents singly, so that one may write a letter in Esperanto, enclose the respective key in the letter, and make himself understood in any country of those several languages. The Esperanto letter can be the same for each country. In certain ways the war has interrupted communication, and hampered the association, especially in cutting down its revenues. All members mobilized are continued in their membership during the war without payment of dues. In other ways the war has stimulated study and furnished new opportunities for use. Both the German and the French governments issued and distributed series of documents in Esperanto to advocate their propaganda. They would not have done this had they not considered the language practical.

Now, as to the merits of Esperanto in itself. Its grammar has nominally 16 rules, at least a half of which are too simple to be compared with what is usually called grammar. The rules are without exceptions, the spelling phonetic, and the spoken accent invariable. The vocabulary is such that a person even moderately familiar with English, French and German, especially the former two, because they embrace in themselves so many Greek and Latin roots, can read a large part of the language at first sight, without a dictionary. Good dictionaries exist and are cheap in price. Many technical dictionaries have been published, and more are coming. The advantage of what is called an artificial language is that it may be accommodated to the use for which it is made. Natural languages are beyond control. Yet Esperanto borders so closely on natural languages that it partakes of many of their advantages without losing its own. The spelling and pronunciation of English and even of French offer many obstacles to the use of those languages by foreigners, they are even stumbling blocks to natives. Other languages are to us, at least, more difficult, some almost unattainable, and to the mass of persons, quite so. You suggest a choice of English, French and Latin for world use. Either of them for such use, would necessarily undergo immense changes, but Esperanto, prejudicing none of them, can draw from each all its useful qualities.

BOPOMANO.

Navy Identification Tags, A Correction

IN our issue of December 1st we described the metallic identification tags which have been adopted for use in the United States Navy, and stated that the design and the process of manufacture were alike to be attributed to Mr. J. H. Taylor, Finger Print Expert of the Bureau of Navigation. This statement, it now appears, calls for a slight amendment.

The original abstract idea of employing some kind of an indestructible tag bearing finger print or other date was actually Mr. Taylor's. This bare idea he put before the Bureau of Standards, with the request that they seek a way of putting it into practice. While it is possible that Mr. Taylor had thought of etching the data on metal before he took the matter up with the Bureau, he did not make this concrete suggestion to them, or attempt to assist them in any way in their investigation; and in this he displayed good judgment, for the Bureau of Standards is the one department of the Government supremely qualified to prosecute such an affair.

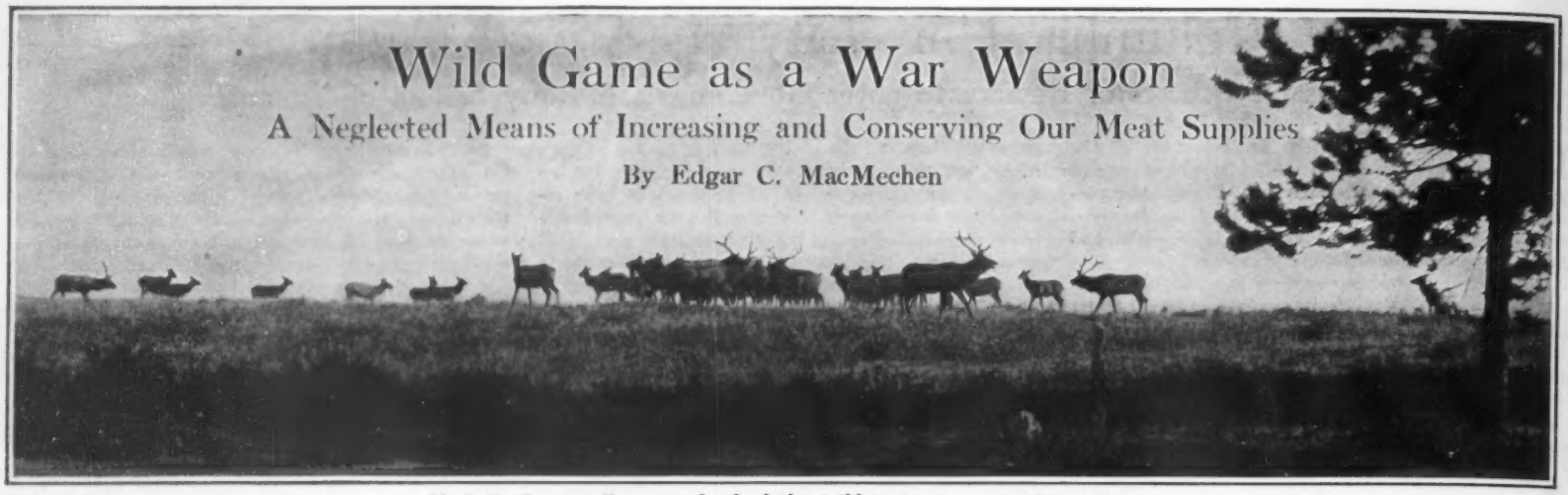
The Bureau rendered a report to Mr. Taylor on April 13th, 1917, and this report formed the basis of the method adopted for use by the Navy Department. It was arranged that a patent be issued in Mr. Taylor's name, and be immediately assigned to the United States; the number of this patent is 1,246,753. It was this circumstance which led to our crediting the whole business to Mr. Taylor; and we are very glad to correct this, and to state that while he may properly be recognized as having incubated the bare bones of the idea, the Bureau of Standards is responsible for the concrete invention.

It also develops that we stated incorrectly the melting point of these tags. The Naval authorities from whom we got our information, were under the impression that this was 3840° for Monell metal; it is really in the neighborhood of 2500°, as pointed out to us by the manufacturers—quite a discrepancy.

Wild Game as a War Weapon

A Neglected Means of Increasing and Conserving Our Meat Supplies

By Edgar C. MacMechen



Six bull elks rounding up a herd of about thirty cows on a western range

NECESSITY for conservation of food supplies has been so thoroughly impressed upon the people since America's entry into the war that, at last, there are signs of an adequate movement for wild game preservation as an economic proposition. The wonder is not that this subject has come to the front, but that it has been overlooked so long. We have seen enacted national laws for the conservation of timber, water, minerals, coal, but aside from isolated cases, game propagation has not been truly a national question.

In a recent statement by the national food administration the decrease in the world's meat-producing animals since the invasion of Belgium is given as 114,505,000, divided as follows: cattle, 28,080,000; sheep 54,000,000; hogs, 32,425,000. The United States, which boasts that it can feed the world, has fared a little better, to wit; cattle increase, 7,079,000; sheep decrease, 3,000,000; hog increase, 6,275,000.

With the United States armies added to those of the Entente powers, who will venture to assert that the United States can maintain her meat-producing herds? During 1917 the meat exports of this country increased from 493,848,000 to 1,339,193,000 pounds, while breeding stock has been slaughtered ruthlessly in many of the countries at war. When these facts are considered the importance of systematic wild game propagation to create a supplemental meat supply becomes apparent.

The most cursory reference to American history establishes the fact that the great game herds of the North American continent made possible the phenomenal development of this country, and deserve, in recognition of this service, a place among the nation's most valuable resources. The transcontinental railroads were built, in a figurative sense, upon the bodies of the bison. Engineers, contractors, laborers were entirely dependent upon the wild meat killed by paid hunters. Hundreds of men were similiarly employed to furnish forts, trading posts, fur depots and early settlements. Then there were thousands, and tens of thousands, slaughtered for their tongues or robes, the rest of the carcass serving to increase the coyote and wolf population. When America was discovered there existed, according to various estimates, between 30,000,000 and 60,000,000 bison in North America. By 1898 this number had shrunk to 800 when, for sentimental reasons, the American Bison Society was formed and saved the animal from total extinction. There are now 4,000 buffalo in North America. As a practical basis for furnishing a supplemental meat supply the buffalo is still a negligible quantity, although he may become an important factor at some distant date.

Considered from all standpoints, however, the greatest meat-producing wild species in America remains in sufficient quantity to make its propagation for this purpose practical and profitable. There are 40,000 specimens of the wapiti, or American elk, in this country, according to the most conservative estimates of the United States biological survey. Many authorities place the number between 80,000 and 100,000. Thirty thousand of these animals are in Wyoming, where the present game laws permit an open season of 45 days on elk.

Wapiti cows with calves. At this season the bulls herd by themselves in the heavy timber

Each person who secures a hunting license is allowed to kill two elk, without sex distinction.

The federal government, through the forestry bureau of the Department of Agriculture, began to stock national forests with elk from the Jackson Hole and Yellowstone herds in 1909, but hunting on national forests in conformity with the game laws of the states is permitted. Wyoming has established state game preserves, but these are unfenced and the despicable tusk hunter plays havoc with the elk.

If elk propagation for meat purposes is to be seriously undertaken the fenced preserve, where no hunting is allowed, is the only solution. In establishing its six bison preserves the national government fenced them. A number of states have game farms, but, in most instances, these are unfenced and devoted more to bird preservation than to big game propagation. There is nothing to prevent the national and local governments and private interests from combining in the movement.

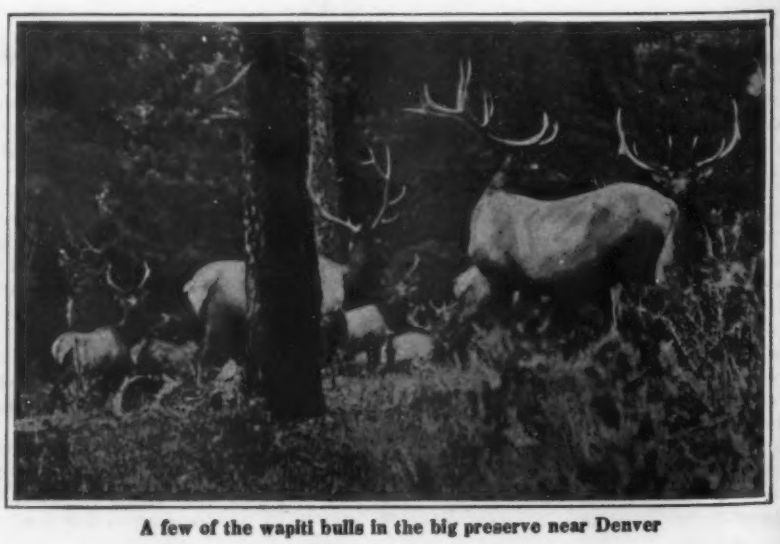
Actual demonstration of what may be accomplished in a public way has been given by the City of Denver which, for the last three years, has conducted a wild game preserve, kept records of the cost, the increase in the herds and the improvements in breeding conditions that show what may be done. There are, in the Genesee Preserve, buffalo, elk, deer, big-horn sheep and antelope, but the experiment in elk propagation has proven of most interest from a practical standpoint.

The strongest arguments for systematic elk propagation are that the animal responds readily to the slightest protection, and is close second to some species of deer from the reproductive standpoint. Even confinement in a zoo yard has less effect upon the fecundity of an elk than upon that of most wild animals. An especially strong point in the elk's favor is that elk flesh more nearly approximates beef in flavor and quality than any other wild meat. All game hunters and frontiersmen know that the human palate tires of game. But elk flesh may be eaten day in and day out with as much relish as beef. In this respect it is far superior to deer meat.

Elk will multiply as rapidly as will reindeer. Furthermore, the reindeer is a descendant of the barren ground caribou and, it is reasonable to suppose, the elk with its placid disposition would yield as readily to domestication as his northern relative. It has not been many years since a resident of Denver frequently drove a harnessed team of elk through the streets to the great annoyance of horses. Elk meat also is superior in flavor to reindeer flesh, which has the gamey taste.

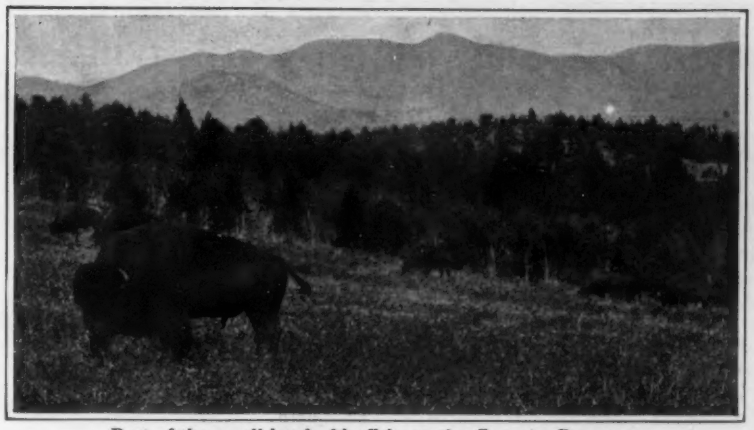
Denver began her experimentation in game propagation about three years ago, placing 23 elk in Genesee enclosure in the summer of 1915. The preserve then embraced 165 acres, to which was added 235 acres the following summer. The area includes heavy shelter of pines, spruces and quaking aspens, grassy upland meadows, ravines and rocky points. The park authorities purchased and fed only three tons of hay during the winter, although seven buffalo and a few deer and antelope shared the stack.

Four of Denver's ten big-horn sheep



A few of the wapiti bulls in the big preserve near Denver

Nineteen of the elk were cows, several being unproductive yearlings. The increase the following summer was 15 calves. Five adult females were added in the fall of 1916, and the increase during the summer of 1917 was 20 calves. This indicates an average reproductive power of 80 per cent of the females, a little better than the biological survey estimate of 75 per cent increase annually among the cow elk of the Jackson Hole herd. The total number now in the preserve, with additions made in the fall of 1917, is 75 head. To meet conditions in 1918 the Denver park authorities must do one of three things: expand the enclosure, liberate the surplus upon the open range or place a certain per cent upon the market. The buffalo herd now numbers 15 and room must be allowed for a new herd of 20 prong-horned antelope.



Part of the small herd of buffalo on the Genesee Preserve

The park authorities have already decided upon the first of the alternatives, and will add 500 or 600 acres to the preserve next summer. Slaughter of elk will not be resorted to unless elk propagation for human consumption is made a national necessity and a duty. In the meantime Denver is getting ready for eventualities. City authorities have investigated the possibilities in this line with some important results. The effort has been to make all figures and estimates conservative, both as to weight of the animals and ratio of increase.

A mature bull elk will weigh from 750 to 800 pounds. A mature cow will weigh from 400 to 450 pounds. The males average roughly 50 per cent of the annual increase and by converting them into steers the weight per male animal could be raised easily to 1,000 pounds each.

The cost of maintaining an elk herd in a preserve like that near Denver is remarkably low. Land generally regarded as waste land makes excellent game pasturage, another important conservation point. Elk browse upon underbrush, like the goat, but without damaging the plants to the same extent. The winter of 1916-17 in Colorado, as shown by weather bureau statistics, was unusually severe and prolonged, yet only 20 tons of hay were fed to the 100 ruminants then in the Genesee enclosure. This hay was raised on land owned by the city and adjacent to the preserve, but, had the city paid $25 a ton for this hay, a figure reached by hay at times during the last few years, the cost of raising a two-year old elk would be only $10. The average cost of fattening a two-year old beef animal, as computed by stockmen of the West, varies from $50 to $75, according to the degree of finish.

The only way in which to estimate the potential meat-producing value of elk or deer herds is to take as basic examples preserves such as the Genesee enclosure, and statements of wild game authorities. Thus, the state of Vermont, where in 1870 the white-tailed deer was extinct, imported through citizens of the Town of Rutland, seven female and six male deer in 1875, and 22 years later held the first open season. One hundred and fifty deer were shot. By 1909 this number had been increased to 5,261, the total weight of venison represented being 716,358 pounds, worth at 12 cents per pound, $85,358. All this came from those original 13 deer. Today venison is quoted hog-dressed at 25 cents a pound.

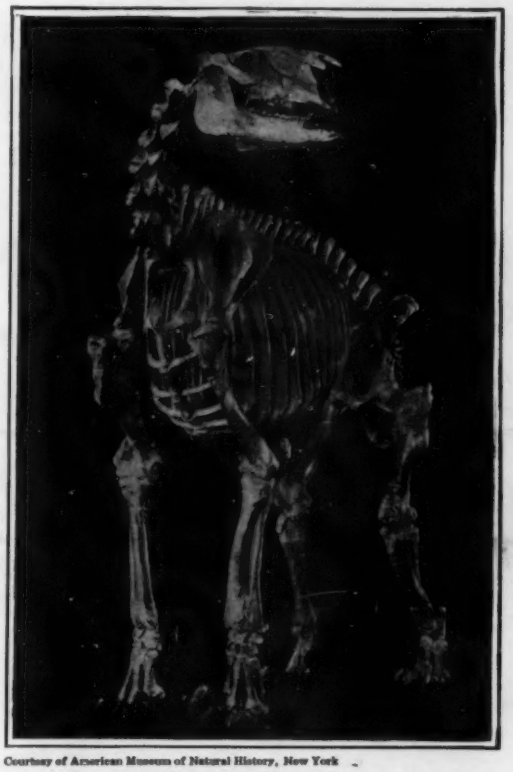
A fenced enclosure of 25,000 acres in one of the national forests of the West, stocked with 2,000 females and 400 adult males, would grow in three years into a permanent herd of breeding elk which, allowing each animal 5½ acres of grazing land, would take up the entire capacity of the preserve. After this third year the annual increase at the rate of 75 per cent of the breeding cows would be 2,850 young a year. If this prospective preserve is increased by ten the annual yield would be 28,500. After deducting 3,500 as future breeders, the annual marketable stock of elk would be 25,000.

The heaviest cost in the establishment of such preserves would come in the trapping and shipping of the animals. The cost per linear mile of fencing the government bison ranges averaged about $1,100, as against the average of $700 for the Genesee fence, constructed of old engine-boiler pipes, set in concrete, over which was strung the woven wire fence. At the higher figure the cost of fencing the projected preserves would be between $60,000 and $70,000. Wyoming appropriates $5,000 annually to feed the Jackson Hole elk herd of 30,000 head.

The establishment of the ten preserves would require an initial stock of 24,000 elk. These could be taken from existing herds safely, and herds at liberty soon brought back to their present numbers with enforcement of closed seasons for a few years. The shipping difficulty could be moderated greatly by the creation of the proposed preserves in the neighborhood of the present elk centers of population.

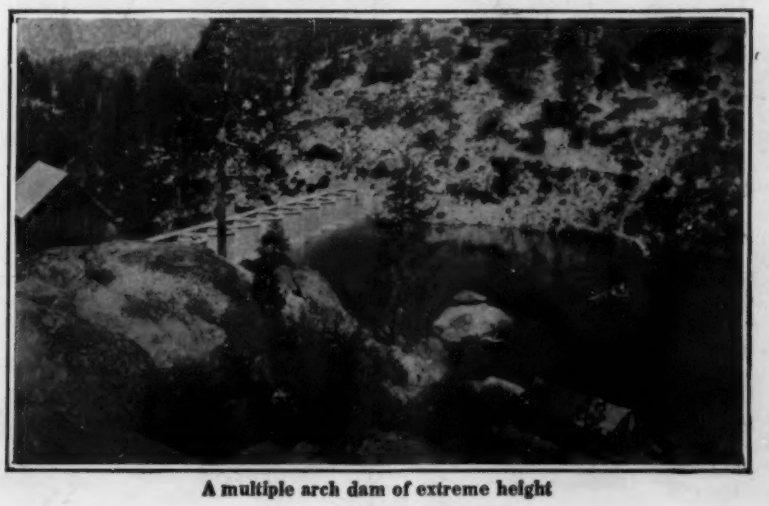
As a means of providing the entire nation with meat the propagation of elk need not be considered, because then they would necessarily occupy valuable agricultural ground, and the great trinity of livestock, cattle, sheep and hogs, will always hold their popularity. But, as a supplemental meat supply, to relieve an emergency *after the war*, when it will become imperative that every nation shall conserve its breeding stock of domestic animals, and when there will be the most vital need for meat animals to feed bruised and bleeding humanity, such a meat supply would prove sufficiently valuable to be eagerly welcomed by stock grower and consumer alike. To make such a production of considerable effect the government, the states, and municipalities must play their parts. Then, once more, will the great game herds of America forward civilization.

It is to be hoped, however, that if they serve humanity as they served it during the great development periods of this nation's history, they will not reap the same reward—a hail of leaden bullets and near-extermination.



Courtesy of American Museum of Natural History, New York

Skeleton of Moropus, the clawed ungulate



A multiple arch dam of extreme height

A Horse With Claws

ONE of the oddest beasts of all time has recently been placed on exhibition in skeleton form in the American Museum of Natural History, New York. This creature is in general appearance a weird combination of horse, rhinoceros, camel and giraffe—but it has an enormous claw on each front foot and a smaller one on each hind foot. It is this feature which gives it claim to uniqueness; for by all the rules of the game it should have hoofs, not claws.

The large herbivorous animals of today possess hoofs; nearly all of their extinct predecessors were similarly outfitted. The feet of a vegetarian serve merely for locomotion, not for attacking other animals, tearing apart of food, or digging, the purposes for which other species are provided with claws. So general is the rule that only carnivores may have claws that for many years it was supposed to be a universal law of nature, and Cuvier included it in his Law of Correlation. So great was his confidence in the law that hoofs and horns were the sole prerogatives of the herbivorous animals that it became proverbial among the scientists of his day, and led to a very amusing anecdote which was universally believed.

It was related that one of Cuvier's students who wished to give his master a scare rigged himself out as the devil, with the traditional horns and cloven hoofs and barbed tail. He stole into the savant's room at midnight and, standing over the bedside, roused him from sleep with the words, "Cuvier, Cuvier, wake up; I am the devil and am come to eat you." The scientist roused sufficiently to look his visitor over, and then mumbled, "Hm—horns, hoofs—you're graminivorous—you can't do it." Whereupon he promptly rolled over and went to sleep again, while the baffled jokester withdrew in confusion from the scene of his defeat.

The moropus, which we illustrate, is a prehistoric contradiction of Cuvier's law. When the first scattered bones of this animal and its fossil relatives were discovered in Europe, the teeth and skull parts were associated with an extinct ungulate somewhat on the order of the rhinoceros, the horse, or the tapir, while no less an authority than Cuvier himself identified the claws as pertaining to a giant ant-eater—a reasonable enough guess, as our cut makes plain. No entire skeletons have been found in Europe, so it was a long time before these contradictory parts were recognized as belonging to the same animal. Not until the Agate Spring fossil quarry in Nebraska was discovered was detailed information available about the creature. This quarry was opened and worked on a large scale by the Carnegie Museum of Pittsburgh, and there were obtained a number of more or less incomplete moropus skeletons, as well as many of the little pair-horned rhinoceros and the giant pig. Within the past few years, however, the Natural History Museum has been working this field, and has unearthed seventeen complete skeletons.

It is now shown that the moropus was a distant relative of the three ungulates mentioned above. It has the size of the rhinoceros, with the same massive legs, though these parts are much longer than in the familiar horned beauty. The rounded back resembles that of the tapir, while the head and neck are those of the horse. The teeth and feet are distinctive; the former show beyond dispute that the animal browsed on vegetation, while the latter possess the claws already described. What use their owner made of these is still a puzzle. They could have been of little value in a fight, for the whole limb is too stiff and clumsy for good use in that direction. For the same reason they could have been of small consequence as a digging mechanism. It is suggested that they were designed to aid the animal in scraping away sand in dry river beds in the effort to make a waterhole at which he might quench his thirst.

Another Multiple-Arch Dam

IN our issue of September 8th we summarized the trend of recent engineering practice toward the multiple-arch dam, and told why under certain conditions this construction was regarded with favor. We illustrated this discussion with views of two dams from the northwest, both of which were built with the sharp slope of the upstream face carried clear up to the top of the dam.

While the thick bottom and narrower top demanded by considerations of safety make this sloping face a necessity, it will be recalled that in our previous article we spoke of the inconvenience resulting from making the brow too thin. Yet if the height be considerable it would seem at first blush that this was the only alternative to making the bottom thick to the point

(Concluded on page 95)

World Markets for American Manufactures

Conducted by WILLIAM W. SNIFFIN

A department devoted to the extension of American trade in foreign lands

Agricultural Implements and Machinery

EXPORTS of agricultural implements and machinery from the United States have very generally found successful markets in foreign countries. Even in the face of unusually keen competition, these manufactured goods have in certain countries had remarkable sales. Their merits have been so conspicuous that certain nations have gained a foothold for their own manufactured exports in several markets largely by imitating the American product. Exports from the United States of implements and machinery for agricultural purposes amounted to $26,552,826 during the fiscal year ending last June 30th.

Prior to the war Russia was a good buyer of American agricultural supplies and, except for political contingencies that cannot be foretold, this market should continue good after the cessation of hostilities and the restoration of normal transportation facilities. In the years preceding 1914 Russian factories of agricultural implements produced about fifty-five per cent of the country's needs, valued at 60,000,000 rubles, while the balance—to the value of about 50,000,000 rubles—was imported from the United States, Canada, Great Britain and Germany. During the war, however, home production has been reduced, owing to the commandeering of factories by the Government, the shortage of labor and the disorganization of the last few months resulting from the unsettled political conditions. The output in 1917 was but 15 per cent of the normal output of 1913. Imports, also, of course, have fallen off during the past three and one-half years and amounted in 1916 to only about twenty per cent of the 1913 imports.

With the view of improving conditions to some extent, a government monopoly was extended in 1917 over the sale of agricultural machinery and implements manufactured in Russia, but no definitely successful results have so far been obtained. While the difficulties of the ruble exchange last and as long as the cost of ocean transportation and the cost of machinery from foreign countries continue as high as they are now—the latter amounting in the case of some countries, and among others the United States to 100 per cent more than in 1916—imports of agricultural implements and machinery will be reduced to a minimum. However, the orders to be placed abroad for delivery for the 1918 season will, it was decided at a recent conference of the Associated Manufacturers of Agricultural Machinery in Russia, include the following: Mowers, 35,000; horse rakes, 25,000; binders, 10,000; hay forks, 100,200; and scythes, 2,500,000.

Portugal is another country much affected by the high wages and scarce labor that have followed as one of the results of the war. In consequence of this situation, farm owners are investigating farm implements and intensive farming with much interest. During the year 1916, the total net value of the agricultural production of Portugal was $140,000,000, while the value of the capital invested, exclusive of the value of farm lands, was $275,000,000. American supplies of agricultural implements, though encountering severe competition from European countries, both in the lower cost of the products and in long term credits, were always much sought after in Portugal. As has so frequently happened in all parts of the world during the progress of the war, Portugal has been forced to develop a home industry for the production of agricultural implements. Notwithstanding this, however, there is a market in that country for pitch-forks, manure forks, sickles, hoes, scythes, sheep shears, corn knives, machetes (African trade), hay knives and hay forks and also small tractors, plows, harrows, harvesters, threshing machines, hand pumps, corn planters, potato planters, hay-baling presses, manure spreaders and feed grinders. Some conservatism will be met with in selling these implements, owing to customs of long-standing, but the opportunity exists and important results can be obtained if proper patience and care are observed. Farming operations continue throughout the year in Portugal and two crops per annum are far from being an exceptional event.

In France, too, there is a need for agricultural machinery and the United States Government has undertaken to supply 1,500 tractors by next spring, so that a much larger acreage can be placed under cultivation than has been done since the war began. The French Government plans to put under cultivation as soon as possible those portions of French territory that have been regained from the enemy. Government agencies in France are encouraging the use of agricultural machinery in the effort to compensate especially for the shortage of men, and it is said that the farming operations of 1918 for the spring and autumn will require from three thousand to four thousand new tractors.

In Mexico the need for agricultural machinery is keenly felt and recent information from Mexico City is to the effect that, with the sanction of President Carranza, the Mexican Department of Agriculture will assume the general agency for the entire republic of a large American firm engaged in the manufacture of agricultural machinery. This arrangement is made with the idea that the smaller landowners may purchase tractors, machinery and other farming implements at a very low cost.

Agricultural implements and machinery from the United States have always had a good market in nearly all of the South American countries. Machinery for operation on a large scale has been especially desired in certain countries, such as Argentina. In Cuba too, the demand for modern farming machinery of large capacity is increasing.

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Harvesting on the Pampas of Argentine

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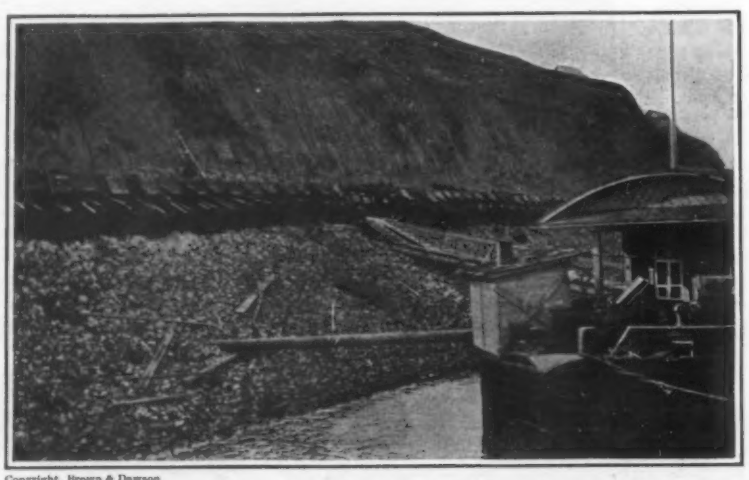
Threshing in the Philippines



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American machinery being brought to Russia on the lower Volga

Registration of Trademarks Abroad

MUCH trouble has been experienced by American manufacturers exporting to certain countries, owing to a lack of adequate protection for their trademarked goods. Insufficient attention to the laws of the country of destination would appear to account for the trouble in many cases. Manufacturers and exporters selling trademarked goods in foreign countries, particularly in South America, should, therefore, be interested in the following important facts:

In Argentina, Bolivia, Chile, Costa Rica, Cuba, Guatemala, Paraguay, Peru and Venezuela, trademark titles depend absolutely upon priority of registration. Moreover, any one may lawfully register a United States trademark (registered or unregistered), and thus prevent the entry of the goods involved into that country. There is a report on good authority that the enemies of this country are now registering United States trademarks in these countries through "dummies." Thus manufacturers who anticipate exporting trademarked products may find themselves blocked in their efforts to do so, unless adequate steps are taken to meet the contingency.

In the case of Brazil, Cuba, Guatemala and Panama, the trademark must be registered in the United States Patent Office before it can be registered in those countries. In Ecuador, Mexico and Nicaragua no suit may be brought for infringement of a trademark without registration.

Packing Goods for Export

AMERICAN exporters appear to have taken to heart the often reiterated complaint of foreign buyers that little attention has been given to the matter of packing goods adequately and in accordance with instructions. Improvement along this line seems to be fairly general. Thus a recent report from Grosvenor M. Jones, a special agent of the United States Bureau of Foreign and Domestic Commerce, who is now in South America, states that American cement deserves favorable comment on account of its good export packing. During his recent tour of the west coast of South America, Mr. Jones observed hundreds of barrels of American cement, and with comparatively few exceptions they had arrived at their port of destination in excellent condition.

Photographs taken recently at Santiago, Chile, of cement shipments, one lot from the United States and the other from Europe, furnish a contrast that is favorable to our shippers. The European lot was on a lighter alongside the dock, and the heads of several of the barrels were broken in. The American lot, which was on one of the docks, revealed no such defects in packing. On the contrary, the barrels had a strip of board across each head, a protection which, it appears, is always found on American cement packages, though not on other barrels.

Trade with the Canary Islands

DIRECT imports of American goods to the Canary ports have made large gains in recent months owing principally to the operation of an American managed steamship line direct to the islands. Canned goods, flour, lard and hardware (especially shook nails and small tools), lead, and cotton goods, automobiles, and drugs showed surprising gains. As in 1915, automobiles from the United States dominated this market, the landed values being $55,000 in 1915 and $69,320 in 1916 in ten months. American coal with a landed value of $167,840 was imported in 1916—a gain of $121,216 over the preceding 12 months.

The total imports from this country into the Canary Islands for 1914 was $608,245, increasing to $737,205 in 1915. Exports to this country amounted to only $3,025 in 1914, but increased to $9,802 in 1915. All the lumber and practically all the petroleum and gasoline imported into the Canary Islands in 1915 was bought in the United States. Moreover, this country sold to the people of the islands more manufactured tobacco than all the other countries combined.

Black-and-white striped suit for the use of snipers stationed in tree tops

Camouflaged listening post in the form of a papier maché carcass of a horse

Striped Suits and Papier Maché Carcasses as Camouflage

DUE to the extent and the standing of our motion-picture industry, there is every reason to believe that the American Army will be well provided with expert camoufleurs when it enters the trenches in force. For after all, the art of deception as far as scenery is concerned, attains perhaps its highest development in the American motion-picture studios. And many motion-picture scene painters and carpenters are now in the camouflage section of our Army.

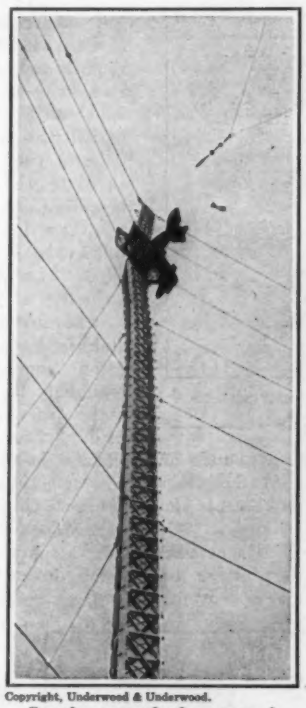
Two interesting bits of American camouflage are presented in the accompanying illustrations. The first of these is a suit in black and white, which is worn over the regular uniform of the sniper in the war zone. This suit is especially designed for tree climbing, and its pattern serves to blend with the background of foliage. The other illustration represents a camouflaged listening post in the shape of a papier maché carcass of a horse. Even when viewed a short distance away this clever camouflage is most effective, especially on battlefields where carcasses are scattered about. The usual practice is to model such a carcass after that of a horse which has been killed at a point near the enemy trenches, and on a suitable night the real carcass is replaced by the camouflaged carcass so as not to arouse the suspicions of the enemy. The observer hiding in this listening post during the day, is relieved at night.

An Aerial Grounding

BIRDMEN have been known to alight in trees and on house tops, but the accompanying illustration is undoubtedly unique in that it represents a British seaplane caught in the framework of a wireless tower over three hundred feet high.

It appears that the seaplane was returning from a flight during a heavy fog. Suddenly, and without warning, the tall wireless tower loomed up before the pilot. Unable to act in sufficient time to avert the crash, the machine collided nose-on with the tall structure and became firmly embedded in the manner shown. The pilot, who was stunned, was flung from his seat and fell on one of the planes, where he lay unconscious some twenty-eight stories above the ground. The seaplane's propeller was so tightly wedged in the lattice work of the wireless tower that the machine stuck out at right angles.

A small body of bluejackets was at work painting the tower. One of them, a seaman of the Naval Reserve named Rath, climbed up the inside of the mast until he reached the machine, and then crawled out onto the plane to hold the pilot until help came. Two more men, ordinary seaman Knoulton and deckhand Abbott, passed a rope out to him, which Rath secured to the waist of the pilot and lowered him to safety. The gallantry of these men is accentuated by the fact that the mast was badly battered, and might have collapsed at almost any moment. The damaged fuselage was only held in place by its damaged propeller, as already stated, and obviously its hold was none too secure especially with the stiff wind then blowing which swayed the mast considerably.



Seaplane perched on top of 300-foot tower

The seaplane pilot owes his life to the intrepid gallantry of these three men, who, while fully aware of the risks they ran, performed the rescue without regard for personal safety. The Albert medal will probably be rewarded them for their bravery.

The general construction, particularly the intricate bracing, of the wireless tower is most interesting.

One exposure after another can be made with this airplane magazine camera

How the Aerial Photographer Snaps His Views

ONE of the simpler types of camera employed in aerial photography at the front is shown in the accompanying illustration, installed on an airplane of the British Royal Flying Corps. This camera, it will be noted, is strapped to the side of the airplane fuselage, and the wing below is cut away to permit of downward vision. The camera is of the focal plane shutter variety and is evidently operated by pulling the rod or string running to the cockpit. A plate magazine is arranged above the camera, and it is reported that one plate after another can be exposed by a simple movement.

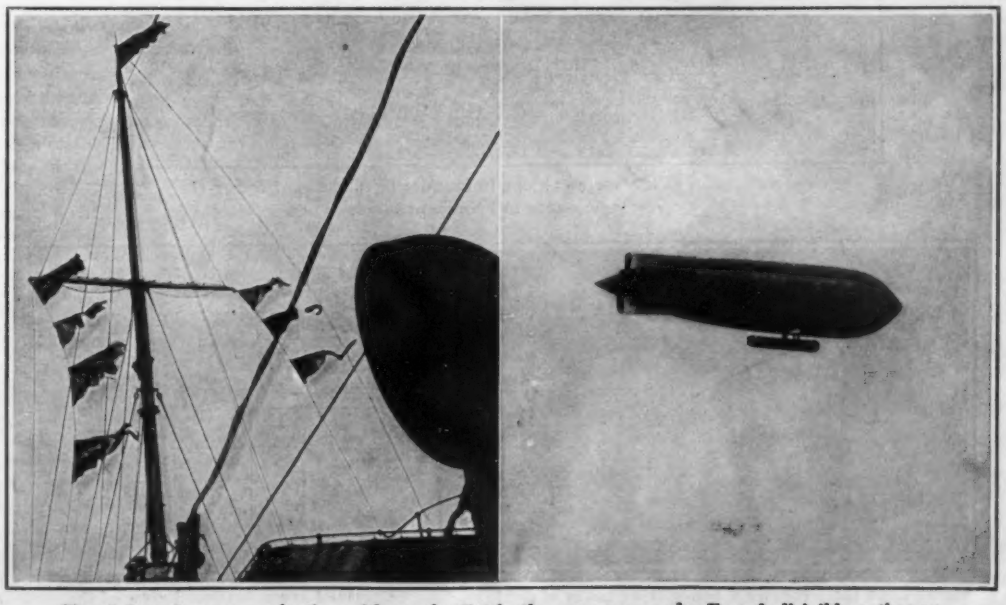
The Cost of By-Product Potash

A PROMINENT man identified with a large American cement company makes the following statement regarding the cost of recovering potash as a by-product from cement. Under present conditions our cost here is running approximately $30 per ton of pure K_2O packed on board cars. This, however, is the manufacturing cost and does not include royalty, depreciation and similar items. Under normal conditions of operation it would be possible to reduce this cost very materially, probably by as much as 50 per cent; therefore it would seem that we have here a source of potash which can compete with the German article under any conceivable market conditions. While the present production of potash from this source is not very great, the potential possibilities are enormous especially when the use of high potash materials for the manufacture of cement is taken into consideration. Plants are now installing apparatus for the recovery of by-product potash.

Air Pilots for Ships in the War Zone

NOT alone submarines but mines as well are a constant menace to ships entering British and French ports. If anything, the mines present the greatest danger; for aside from the presence of mines that have broken away from their moorings in the extensive mine fields, there are those distributed broadcast about Allied coasts by German mine-laying submarines.

Fortunately, submarines and mines are readily detected from aircraft, so that their usual concealment is no longer effective. To this end the Allies are making use of fleets of fast airships the purpose of which is to pilot friendly vessels through the danger zones. These airships generally communicate with the piloted ship or ships by means of signal flags, and in this manner the otherwise concealed submarines and mines are avoided by the seamen. The accompanying illustrations depict one of the dirigibles employed by the French as an air pilot for ships entering or leaving one of the Atlantic ports, as well as the signal flags on a mast of the piloted ship.



Signal flags for communicating with an air pilot in the war zone, and a French dirigible acting as air pilot.

Inventions New and Interesting

A Department Devoted to Pioneer Work in the Arts

Tire Chains for Slippery Feet

FOR weeks the streets of New York, Chicago, and various other American cities have been covered with a thick layer of smooth ice, resulting in an uncertain footing for pedestrians and in an unusual number of falls. Rubbers have been of but little use as a means of maintaining one's equilibrium on the slippery surface. Indeed, to many, particularly the aged folk, the icy pavements have been a constant source of terror.

Whether the ice remains or not, relief is in sight. The introduction of the tire chain principle for pedestrians now promises to solve the icy pavement problem. This up-to-the-minute device consists merely of a simple chain net which slips under the sole of each shoe, and a leather strap which passes about the heel and serves to hold the anti-slip member in place. As in the instance of the conventional tire chain, this foot chain effectively prevents slipping.

The pedestrian anti-slip chains

With modified tire chains on each foot one cannot slip

Solderless Connectors for Large Conductors

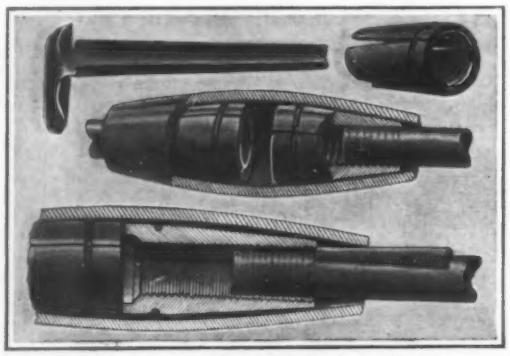
ALMOST ingenious and efficient solderless connector has been invented by Engineer Ingaramo of Milan, Italy, and employed successfully on high power transmission lines through the mountainous regions of that country under the most adverse weather conditions. Indeed, the heavy cables have at times given way under the great strains imposed, while the powerful grip of connectors close at hand has not been shaken.

The details of the solderless connector appear in the accompanying drawing. It will be noted that the connector consists of a short length of copper tubing containing two gripping members, which is tapered at the ends to hold these members in place. Each gripping member consists of three pieces which go to form a truncated cone when assembled, and which are freely held together by a ring. The truncated cone thus formed is hollow and threaded, so as to admit the conductor. The manufacturing process for turning out this type of connector is simplicity itself: a short length of copper tubing is first tapered at one end in a powerful press; the two gripping members are placed in the tube with their bases facing each other; and the other end of the tube is then tapered to complete the connector.

By this time it becomes obvious to the reader that the connector operates on the wedge principle. When a conductor is pushed into the connector, the gripping member at that end slides back and opens to admit it; but the moment the conductor is pulled the threaded faces close and grip it with increasing pressure because of the tapered form of the tube and the resulting wedge effect. So responsive and powerful is this gripping effect that even the slightest push of the conductor into the connector is sufficient to grip it firmly in place. The connector, however, has a slight swivel action rather than a rigid coupling effect, which aids materially in taking care of the transmission line stresses.

In order to release the conductor a stamped steel tool of the type shown in the upper left-hand corner, is employed. The action of this tool is shown in the lower drawing. It merely serves to push back the gripping member and to hold it in the wide portion of the tube to overcome the wedge effect while the conductor is withdrawn.

Engineer Ingaramo's connector is being employed at present on the high power transmission line between Genoa and Turin, a distance of some one hundred miles over rugged mountain country. In all, 8,000 connectors of this type are employed on this 8,500-volt line. Despite the heaviest coating of ice which at times reaches 10 inches in diameter, and despite the most severe wind storms of last winter, the connectors have never been known to fail. Cables on either side of a connector have snapped in some instances, but the connector has held on. The Italian State Railways and several hydro-electric power companies in Italy are using this type of connector.



Details of a solderless connector extensively employed on Italian transmission lines

Laundering Soiled Cotton for French Military Hospitals

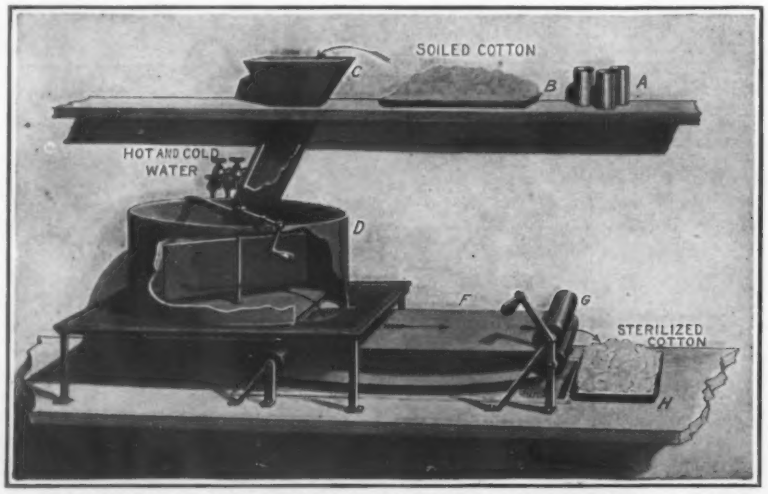
THE problem of supplying absorbent cotton to military hospitals in France has been a tremendous one since the beginning of the war, because of the magnitude of the requirements. For instance, in Paris alone the hospitals require more than four thousand pounds of sterilized cotton per day, and there are other hospitals scattered throughout France with requirements in proportion.

To the French mind it has always seemed a case of gross inefficiency and unpardonable wastefulness to employ absorbent cotton once and then destroy it. So much so, in fact, that M. R. Villey, a French chemist, early in the war conceived a plan for utilizing soiled cotton. His first thought was to clean it and sell it to paper manufacturers, but the price offered for cleansed cotton was too small to warrant the trouble. Next, he considered its use for explosives, but soon found that such cotton underwent certain chemical changes in the washing operations which made it unsuitable for this purpose. Finally, he turned to the laundering of cotton for its reëmployment in military hospitals, and in this he has been entirely successful.

The one big objection which Mr. Villey had to overcome was that of handling soiled cotton which contained dangerous germs. This he met by suggesting the burning of such cotton as contained dangerous infection, and the packing of other cotton at the hospital in hermetically sealed boxes for transportation to the reclaiming station.

The general process of laundering absorbent cotton as worked out by Mr. Villey is shown in the accompanying schematic drawing. The hermetically-sealed containers arrive from the hospitals as shown at *A*, and their contents are emptied on a sorting tray at *B*. If the cotton has been sorted at the hospital in order to eliminate that which is too soiled to reclaim, the sorting tray can be done away with. The cotton is then passed through the chute *C* to the treating tank *D*, where it is first treated with chemicals and then thoroughly washed with hot and cold water. All the while it is constantly stirred by the moving blades *E*. Thoroughly washed, the cotton passes onto the conveyor belt *F* which carries it to the wringer *G*. In the event that the cotton is not sufficiently dried, a special heating chamber is provided. The laundered and dried cotton is deposited in the tray at *H*.

At Montferrand, in the Doubs region, the French have established a large laundering plant for reclaiming soiled cotton from the military hospitals throughout the Republic. It is reported that this plant alone has a capacity of well over 40,000 pounds of laundered cotton per day, at an average cost of about 30 cents per pound. When it is remembered that the French Government pays something like 60 cents a pound for American absorbent cotton, the saving effected by this laundering process soon becomes evident. In fact, with this one plant alone the French Government is saving over a million dollars a year. Several other similar plants are now being planned.



Schematic plan of the various steps in laundering absorbent cotton for re-employment in French hospitals

A Non-Glaring Hand Lamp Which Throws a Beam 500 Feet Long

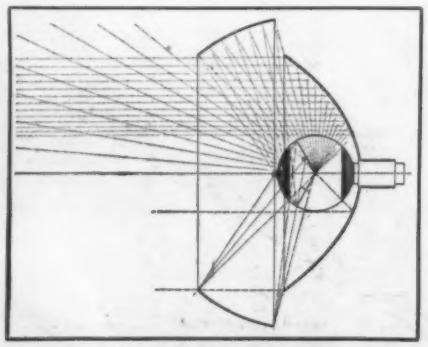
IN a simple form of hand lamp operated on battery power, Mr. J. T. Roffy of Brooklyn, N. Y., appears to have solved the problem of producing a non-glaring searchlight. As a matter of fact his lamp is an exceptionally powerful projector of both spot and diffusive illumination. The concentrated beam of projected light extends 500 feet, while the objects close at hand are illuminated by a diffusive glow of indirect and transmitted light, devoid of the annoying direct filament glare.

According to Mr. Roffy's views, the possibilities in glare reduction while still retaining light projection, lie in minimizing the glare due to direct visibility of the light source and in forming a main reflector of least aboration well concealed from the direct visibility.

How this is carried out in practice is made plain in the accompanying schematic drawing of his lamp. The light source itself is embraced to the angle of 105 deg. with a spherical curve corrected for aboration and, beyond the aperture of the main reflector, there is an annulus of spherical curve whose geometrical focus is at an offset as shown. Therefore the light coming from the filament onto this annulus is not returned on itself but at a distance coinciding with that angle that the frontal screen intercepts. This frontal screen is translucent, and light coming from the filament accordingly

(Concluded on page 95)

This hand lamp throws a non-glaring beam of light a distance of 500 feet



Schematic cross-sectional view of the non-glaring hand lamp

What Will You Do for Motor-Transport?

It is no longer a question whether motor transport is possible, practical or profitable.

It is in actual operation, demonstrating its success daily.

Neither is it a question as to whether this form of transportation should be extended.

The national obligation to *produce* can be met only by every possible extension of every practical method of *delivery*.

The one question left is; how far can you, as an individual, help to relieve freight and express congestion, and accelerate movement of raw materials and finished goods.

Do You Know What Has Been Done?

Already hundreds—if not thousands — of manufacturers, jobbers and transportation companies are maintaining regular service by motor-truck — both outgoing and incoming — between points distant from 20 to 1000 miles, in some cases even further. For example:

Boston to Lawrence, Franklin, New Bedford, Whitman, Campello, Brockton, Bridgewater, Lynn, Peabody, Camp Devens, and other New England points.

Boston to New York, Philadelphia, Washington, and even to Akron, Ohio.

New York to Boston, Philadelphia, Washington, and many points in New York, New Jersey and Connecticut.

Philadelphia to New York, Boston, Washington, Wilmington, Baltimore, Chester, Bethlehem, Allentown, Lancaster, Reading, etc.

Chicago to Elkhart, Gary, Rockford, etc.

Cleveland to Canton, Akron, Elyria, Painesville, Lorain, Kent, Ravenna, Norwalk, Sandusky, etc.

A through service from Chicago to Buffalo, Rochester, New York, Boston and other Eastern points is being projected.

Out in California upwards of fifty concerns report over sixty trucks in regular long distance hauling.

What the Trucks are Carrying

Among other things are iron, steel, coal, ore, lumber, chemicals, rubber goods, building materials, mine supplies, machinery, sheet metal goods, fabrics, corsets, straw hats, earthenware, dyes, wrapping paper, silos, wholesale groceries, farm products, and a large tonnage of raw materials, parts and finished goods for war industries.

Does it Pay?

The best answer to that is to consider a few specific cases.

The Beam-Fletcher Corporation, Hauling Contractors, of Philadelphia, have been maintaining 12-hour service to New York, handling 400 tons daily in each direction. With their fleet of 32 five-ton trucks they also have been reaching points in nine different states.

The Stedman Bent Co. of Philadelphia operate 12 five-ton trucks over a wide area — largely for war industries — reaching Wilmington, Baltimore, Bristol, New York, Trenton, Lancaster, Plainfield, Bethlehem, Allentown, etc.

The Ohio Freight Delivery Co., of Cleveland, are operating one, two and three-and-one-half-ton trucks over country roads between stations at Cleveland, Lorain, Elyria, Akron, Norwalk, Sandusky, Toledo and Canton; and when this advertisement went to press were awaiting delivery of 25 four-ton trucks to meet the increased demand for their service.

Several of the great rubber companies at Akron, Ohio, are maintaining service involving many trucks and long hauls to points in and out of Ohio, one case including a regular service to Boston and return.

At the same time smaller concerns, with few trucks, operate on 20-mile or greater radius from scores of towns and cities in New England and the Middle West.

Such service proves its own commercial practicability.

How Does Time Count in Your Deliveries?

There never was a period in the nation's industrial life when time had such value attached to it — when it could mean as much for either profit or loss.

Motor transportation, moving goods both day and night, avoiding delays, loss, damage and extra labor expense at terminals in loading and unloading, means profit.

Will the Truck Last Long Enough?

Naturally that depends on the quality of the truck, condition of roads and so on.

But as trucks are built nowadays they make astonishing mileage records. Many authenticated instances are at hand of trucks that have covered 100,000 miles in hard service and are still going.

The Biggest Problem is the Road Problem

This fact has been recognized by the Council of National Defense in the formation of The Highways Transport Committee, by the Chamber of Commerce of the United States, by State Councils of Defense, and by many other organizations.

In several states work is actively in progress for the widening and paving of highways, strengthening of bridges, and other necessary steps in preparedness.

Motor transport has already been endorsed by the wise statesman and the practical business man. It has therefore reached the positive stage of *individual responsibility*.

What Can YOU Do to Help?

First — Look into your own delivery problem, and if the facts justify motor transportation, buy trucks and put them to work.

Second — Enlist in the cause of good roads. Use your influence to hasten an appreciation of this great public need in your own town and your own state.

Third — If you have already demonstrated the success of the long haul, let others have the facts. Help your brother business man to profit by your experience.

And make the facts *definite*. Tell the size of your trucks, the length of the haul, character of load — outgoing and incoming — character of roads traversed and figures showing operating expense.

THE TIMKEN ROLLER BEARING CO.
Canton, Ohio

Do Your Bit for Stronger Bridges and Better Roads

Every Ton on the Highway is One Ton Less in the Yards

The Marine Use of Concrete

(*Concluded from page 81*)

the maximum which could occur in practice. Part two of the test was then staged, consisting of an effort to bend the ship back in the opposite direction by filling the two end compartments and emptying the middle one. Both tests turned out satisfactorily; and the lighter was then officially pronounced inspected and passed, and fit for service. That this verdict was no delusion is indicated by the fact that she has been in service ever since, hauling tobacco about the harbor.

An interesting sequel to this story is seen in the launching methods employed with the "Namsenfjord"—methods which will doubtless be followed when her larger successors are put in the water. Launching, be it said, presents other problems than that of moving a large mass. Under normal circumstances a ship lying in the water is supported uniformly at all points; even when the water is moderately rough this condition is seldom departed from materially. But as she stands on the ways before launching, she is supported only at isolated points, and her hull must be rigid enough to bridge the gaps between these points without suffering permanent deflection. As long as she stands still, these gaps are not very wide and no serious stresses are introduced; but as soon as she begins to move, there will be instants when she fails to rest evenly on all her supports, and when she accordingly has to stand up under the strain of bridging a very considerable interval between those with which she is actually in contact.

Now a steel ship is not a bridge, primarily; but we know enough about the laws which govern here so that we can make her sufficiently like a bridge to serve the purpose. But concrete is something else; a concrete ship is not a bridge, and we are not sure that we can make her act like one. If we are building a concrete ship just as a sort of engineering pastime—merely for the fun of seeing what we can do—we can afford to determine its resistance to vertical distortion by trying to break it or bend it; if we succeed in doing either we have proved something, and if we fail and the ship ultimately turns out to be a commercial success we are just so much to the good. Under any circumstances, if there were prospects that the stresses of navigation could ever, in this respect, duplicate those of launching, we could afford to look upon the launching as a test which the ship must pass in order to demonstrate her serviceability. But when we are building ships of stone strictly as a business proposition, we cannot afford to satisfy our curiosity by this empirical process of subjecting them to strains which they will never again be called upon to meet, simply for the sake of knowing whether we can break them in two by trying hard enough. Accordingly, if we are afraid that the fore-and-aft launching might call for more bridge action than our ship is capable of exerting, we will naturally dodge the issue by shoving her off into the water sideways. This, of course, is far from being a novel procedure; but the reasons for adopting it are seldom so clear as in the case of concrete ships.

We have already described the vessel which is shown on another page ready for launching—for this craft is none other than the "Namsenfjord"; and concrete lighters are as we have remarked, nothing new. The floating dry-dock of steel and stone is, however, a decided novelty, and one which cannot be dismissed without some consideration of details.

This dock is 80 feet long by 38 feet wide, outside over-all dimensions, and from top to bottom it stands 20 feet high. The sill is 4½ feet thick, and the side walls 6½ feet at the bottom; so the dock will accommodate a vessel 75 feet long and of 25 feet beam. It consists of nine water-tight compartments, and is equipped with a centrifugal pump, electrically operated, by means of which it will lift a load of 100 tons out of the water in an hour. The reinforcing system is similar to that of the "Namsenfjord," and characteristic of all the Fougner maritime concrete construction.

While this dock is a small one, she is so for commercial reasons only. She was ordered by a Christiania firm of yacht builders, who naturally did not require a very spacious chamber. Very much larger docks of the same type are under construction, and contracts are being negotiated for others with lifting power up to 15,000 tons. The first one was made so small, not because it was felt to be in any way an experiment, but simply because that was the size for which a customer had been found. It has been in use by the purchasers for several months, with complete satisfaction.

The use of concrete for maritime construction is not confined to Norway, though it is there that it has progressed furthest. Because of the scarcity of steel plates and the urgent need of new bottoms, France has seriously taken up the construction of concrete ships. Several shipyards have been built for the exclusive purpose of turning out the ships of stone. We illustrate a small concrete vessel in the yard at Ivry, ready for launching.

Our Most Fashionable Hat for 1918

(*Concluded from page 84*)

from between the separated dies. Passing to another machine, each embryo helmet is placed between cutting dies which, at a single blow, cleave off the four corners and the square sides and give the helmet its ultimate shape. But the edge is not as smooth as it might be, and another operation remains to finish the helmet proper. So it passes on to another section of the plant, where a steel binding or channel-section strip is placed round the rough edge. This is done by an operator who then presses the helmet into a holder so that the binding is securely held in place with its two ends practically touching. Each helmet is then passed to another operator who welds the steel ends together so as to form a solid ring or binding about the rim. For this work an electric spot welder is employed; each helmet is placed between the electrodes, and a slight pull on a lever brings the ends between the poles of an electric circuit. The welding operation is over in an instant, and the helmet is then removed from its holder. Provided with a smooth rim and in every other sense complete, it is now ready for the finishing touches.

The American helmet, like the helmets of other warring nations, is provided with a surface calculated to avoid reflection or glare on the battlefield. The French treat their helmets with a dull blue or brown paint, while the British cover their helmets with paint over which sand is sprinkled so as to break up reflection. In the case of our own helmet we make use of a material which serves to break up reflection, but, at the same time, is a poor conductor of heat. This is a most important consideration; for we are told that British troops suffer not a little from the sun's rays striking on their sand-covered helmets during warm weather. And this is the very thing we have avoided. Of course, canvas covers can be used to shield the helmets; but it is preferable to make the helmet complete in itself.

Obviously, the finishing of the helmet calls for a head strap and the special lining. Like the British helmet, ours is provided with an inner frame separated from the steel covering by shock-absorbing members, so that bullets and blows are not communicated to the wearer. The completed helmet has excellent bullet-resisting powers; indeed, the tests are most exacting—and they should be; for after all, is not the stopping of bullets and shell splinters the *raison d'être* of the helmet? Yet the comfort of the wearer has been carefully considered. Consistent with the proper degree of safety, the helmet has been kept down to slightly over two pounds, ready to wear.

A Bibliography of Fruit-Drying

AS the drying of fruit and vegetables has become a subject of urgent importance, much interest attaches to the bibliography of "Dehydrated Foods" prepared by Miss Perrie Jones, of the New York Public Library, and published in the *Bulletin* of that institution for last October. It includes nearly 200 references, covering the years 1885-1917.

Another Multiple-Arch Dam

(Concluded from page 89)

of extravagance, or the sloping face too nearly upright for the best results.

A correspondent in Riverside, Cal., shows us the accompanying photograph as making plain the way out of this dilemma. The impression which this view gives of great depth of canyon is in accord with the facts, so that the problem which we have just outlined was here met in all its force. So the builders have made the dam of normal thickness at the base, have carried it up at a normal angle until it was not safe to thin it any further, and have then brought it straight up from that point, steering very neatly in this way between the Scylla and Charybdis which confronted them.

The dam which we picture here is that at Bear Valley, and was constructed in 1911-12 to store up irrigation water for Redlands and neighboring towns. It replaced a single arch structure a few yards further upstream, which is still partly intact, as demonstrated by the break which it still makes in the surface of the stream.

A Non-Glaring Hand Lamp Which Throws a Beam 500 Feet Long

(Concluded from page 92)

partly illuminates it, while light coming from the annulus impinges on the outer surface of the screen. The screen becomes highly illuminated and is then a source of diffused illumination. Being slightly beyond the focal point of the main reflector, it also acts as a source of illumination in conjunction with the spherical reflector. The result is a highly efficient projected beam augmented by non-glare diffused illumination.

Mr. Roffy states that in his experiments he has found that the critical angle of reflection for metal reflectors takes place at 52½ deg.; that is, whenever a reflector is made to embrace a light source beyond 105 deg. the resultant increase of light flux is a positive detriment to visibility at a distance.

The Current Supplement

SUBMARINE warfare will undoubtedly be a vital problem as long as the present war continues; and, although much has already been published on the subject, the article on *The Submarine* in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2195, for January 26, will be found of value, treating as it does on the influence of the war on submarine policy. The rapid production of ships is one of the pressing problems of the war, and intensive study has been devoted to the subject in England as well as in this country. One of the important branches of the problem is that of the motive power, for without engines the ships would be useless. An article on *Standard Propeling Engines for British Standard Ships* gives some facts in relation to what is being done on the other side and is accompanied by two excellent illustrations of the type of machinery that has been adopted. *Automotives in the Great War* reviews what the United States is doing in the way of providing transportation for its armies. That women are being employed in great numbers in war work is well known, but that they are now undertaking the heaviest kinds of labor in England is not generally known. This is illustrated in this issue by a number of striking photographs, which are accompanied by a note on *Women in Technical Work* telling of some lines of employment where female labor has been found particularly valuable. The paper on *The Biological Aspects of Warfare* is concluded in this issue. *A Problem in Wooden Shipbuilding* discusses the important question of the preservation of hulls. *The Collocation of Plasmas Within the Cell* is an important biological discussion surveying a mechanical theory of heredity, and is illustrated by numerous diagrams. Other articles of interest include *German Airplane Engines; Evidence of Matter in Space Obstructing the Passage of Light, Effects of Hearing versus Seeing and Science of Bricklaying. The Banana as a Food, Manufacture of Smokeless Powder.*

New Type of English Hard Porcelain

A NEW type of hard porcelain that possess two important advantages has been evolved through researches undertaken by the Central School of Science and Technology in Stoke-on-Trent. The experimenters sought to produce a hard porcelain made wholly of British materials and to compound a body that would "pot" like ordinary earthenware. Specimens of ware exhibited show that both these objects have been accomplished.

The body of the new porcelain is as cheap as or cheaper than ordinary earthenware. The glaze (leadless) is about one-tenth the price of earthenware glaze. Particular satisfaction is expressed with the glaze, which, when fired under suitable conditions, seems equal to anything yet marketed. The firing margin is very large. The oven which was built for experiments—an entirely new type—has proved a great success, and there is no reason why a development of this oven might not be used in the production of ordinary earthenware.

Little difficulty was anticipated with the fire clays, since it was known that there are many suitable fire clays in the country. The saggers used have stood remarkably well, in fact, not more than two or three saggers were lost in over 20 firings to temperatures ranging from Cone No. 10 to Cone No. 16.

The ware produced is capable of being successfully decorated with ordinary colors. People acquainted with hard procelain know that this is not possible with some types. A great defect attaching to the Continental hard porcelain is the limitation of the colors that can be applied.

The firing of the new porcelain is the point that will be regarded most seriously by the manufacturer contemplating its production. The new ware can be fired in either "oxidizing" or "reducing" atmospheres, but the best results are obtained by the "reducing" method, which will involve important modifications in the firing practice now obtaining.

Many interesting problems in connection with the firing have arisen and much work has yet to be done. At present the experimenters are concentrating on faults in manufacture, so that the more probable sources of difficulties and losses will be known. The examination of these is necessarily slow, as it is not possible to fire oftener than once a week if they are to fire under ordinary manufacturing conditions.

Electrically Controlled Filtration

TWO Michiganites have perfected a device for electric control of the feed of lime in a filtration plant, which has been successfully operated in the million-dollar plant at Grand Rapids. The underlying principle is the Wheatstone bridge. A direct current is used, 110 volt, operating through a registration board, a rheostat, a polarized relay, graphite electrodes and an electrically operated hydraulic valve connected with the tank containing the saturated lime solution. The electrodes are submerged in water at a point just before that at which the lime is added.

Under ordinary conditions, when the lime is flowing in the right proportion, the current from the generator passes equally through the arms of the Wheatstone bridge and no effect is produced on the registration board. A decision to add lime calls for the addition of one or more ohms of resistance at the rheostat. This throws the arms out of balance and the current passes through the polarized relay. This is connected with the controlling valve and the connection immediately opens the valve and permits a flow of the lime solution. The lime always lowers the resistance. As soon as the resistance is lowered and more lime is needed the red light on the registration board flashes before the operator. Immediately more resistance is added through the rheostat.

If too much lime is being added a green light shows and the resistance is cut down. The current flows in one direction through the relay and when too much lime is added it flows in an opposite direction and closes the valves of the hydraulic control.

NEW BOOKS, ETC.

CAMPING AND WOODCRAFT. By Horace Kephart. Two volumes. New York: Outing Publishing Company, 1916. 12-mo.; 884 pp.; illustrated. Price, $1.50 per volume net.

This handbook for "vacation campers and for travelers in the wilderness" is based upon the author's well-known "Book of Camping and Woodcraft," but its scope is greatly extended to include the needs of the camper who is satisfied with surroundings not far removed from civilized centers. Here may be learned the ingenious expedients of the veteran camper, and every bit of sage advice and every suggestion have been tested and proved to be sound. The first volume is devoted to camping, as distinguished from woodcraft, and deals with outfitting, tents, clothing, and other equipments; with camp making, the fire, pests of the woods, the dressing of fish and game, and camp cookery in general. The second volume cuts the equipment down to bare essentials, relying largely upon the raw materials of nature; there are chapters on getting lost, pathfinding, the use of the compass, packs for pedestrians, concentrated foods, cabin building, and bark utensils; edible plants and living off the country are considered at some length, and there are hints on accidents and emergencies. Both tenderfoot and veteran will find a veritable mine of golden suggestion in these compact volumes, and may vastly increase the activities and pleasures of the nomadic existence.

GRAPHIC CHARTS FOR THE BUSINESS MAN. By Stephen Gilman, B.Sc., C.P.A. Chicago: LaSalle Extension University, 1917. 8vo.; 62 pp.; illustrated.

The graphic depiction of related business facts is a subject of great and growing interest, and it is dealt with in this pamphlet in easily understandable language. The four steps in the development of the chart form are given, the different kinds of charts are described, and standardization is discussed. There is no department of business in which this device may not be used to advantage, and the writer has taken each department and has shown how the graph may be accurately and efficiently applied to a wider and better defined survey of activities and results. The graphic chart is to business what the map is to geography; it enables the eye to visualize facts directly, and independently of a mass of printed letters and figures. Even these charts, however, may be, and frequently are, misleading, and not the least value of this booklet consists in the juxtaposition of right and wrong methods.

A MUNICIPAL EXPERIMENT. Or the Hall of Records Power Plant. By Reginald Pelham Bolton. New York: The Bureau of Public Service Economics, Inc., 1917. 8vo.; 236 pp.; illustrated.

The experiment referred to is the trial conducted during 1913 to determine the costs of installation and operation of the Hall of Records power plant, in the city of New York. This plant provides lighting, heating and elevator service for several buildings. The test determined the capital expense involved in the establishment of such installations, the fixed charges to be provided by the tax payers upon money borrowed for this purpose, the comparative economy of the purchase by a municipality of service from public systems of steam and electric supplies, and the economic conditions under which a first-class, isolated power plant may be operated to develop its highest possibilities. There is a valuable discussion of physical and financial elements and the resultant findings as disclosed by the trial, and the various phases of the experiment, here so plainly set forth by one of the engineering staff, are worthy of the closest attention of engineers, city officials, and tax payers.

TURKEY: A PAST AND A FUTURE. By A. J. Toynbee. New York: George H. Doran Company, 1917. 8vo.; 90 pp.; with map. Price 15 cents.

A WAR OF LIBERATION. New York: George H. Doran Company, 1917. 12mo.; 47 pp. Price, 15 cents.

We are prone to dismiss Turkey as a nation with an unspeakable present, and to think not at all of her past and her future; since it seems that we must deal with her future sooner or later, Mr. Toynbee has performed a service in replacing our vague ideas with definite, accurate impressions, in bringing us face to face with Turkish Nationalism, the "immediate factor to be reckoned with," and acquainting us with its many aims, political and non-political. Before the possibilities of the country can be developed, scientific knowledge, capital, and organization are necessary; but above all—men; India and Egypt alone seem to offer this man-power, and the author shows how this "drives Turco-German policy upon the horns of a dilemma." In "A War of Liberation," published anonymously but probably compiled by Prof. W. Macneile Dixon of Glasgow, we study German absolutism and the Nemesis that stalks it; there is a paper on the dedication of the New World, which credits Prussian despotism with doing humanity "the signal service of breaking through the crust of indifference and aloofness which had hitherto kept the American people from playing their part in keeping the world safe for democracy;" other papers deal with the revolution in Russia, Prussian "reform," and the new birth of freedom heralded by the events of the past few months.

THEIR CRIMES. Translated from the French. New York and London. Cassell and Company, Ltd., 1917. 8vo.; 64 pp.

The Prefect of Meurthe-et-Moselle, the Mayor of Nancy, and the Mayor of Luneville, have gone through authentic documents and selected therefrom typical examples of German robbery, incendiarism, murder and outrage. These "barely credible acts of brutality and bestiality," attested by the mayors of 26 French towns, do not make pleasant reading, but the writers believe that everyone ought to know how the Germans carry on war; it gives only the bare facts and leaves the reader to form his own conclusions. Any profits accruing from the work are to be devoted to The League of Remembrance or to relief work in Lorraine.

WOMEN'S WORK IN WAR TIME. By W. Irving Bullard. Boston: The Merchants National Bank, 1917. 8vo.; 85 pp. Gratis.

Both the industry and the individual are vitally concerned with the question of replacing men by women in war time. In this most interesting booklet the manager of the Textile Department of The Merchants National Bank considers the question as it has been met in Great Britain. Some twenty trades are dealt with, from the manufacture of clothing and shoes to paper making and woodworking, and under each the departments in which women have been found useful are specifically listed. A table gives the chief features of State labor laws relating to female and child labor. The little work should prove most useful in assisting our manufacturers to avoid costly mistakes in an untried field and in suggesting to them the activities in which women may be substituted for men without injury either to the women or the work.

THE MENTOR. New York: The Mentor Association. Annual subscription, $4; single copies, 20 cents.

Too many of our magazines regard the reader as a child susceptible only to crude colors and jumping-jack fiction; the *Mentor* gives him credit for knowing something and wanting to know more, and it demonstrates the fact that absorption of knowledge may be a natural, restful process, accompanied by the most pleasurable sensations; on each twice-a-month visit it deals with just one subject, which may pertain either to art, literature, science, history, nature, or travel; each number contains six full-page, loose-leaf gravures that are a permanent source of artistic enjoyment. A typical number is that in which Prof. Jacoby presents "Our Planet Neighbors;" there are beautiful plates of the moon and of our American observatories and telescopes, while the text answers many popular questions, is brightened by anecdotes of astronomers and their astounding discoveries, and enables the reader to talk intelligently of our brilliant jewels of the night and the laws that govern their movements.

NAVIGATION. By Harold Jacoby, Rutherford Professor of Astronomy in Columbia University. New York: The Macmillan Company, 1917. 8vo.; 341 pp.; illustrated. Price, $2.25.

Two commendable objects are attained in this timely work addressed to the beginner; first, formal mathematical and astronomical knowledge is not assumed; second, the work is so complete in itself that no other guide except the nautical almanac for the year is absolutely necessary. This simplification and condensation of material cannot, of course, allow of a discussion of all the possible methods of navigation, but the writer has used good judgment in selecting those methods which are approved by modern practice. Both fundamental and incidental problems are simply and sharply placed before the student, and processes such as dead reckoning with and without logarithms, and instruments such as the compass and the sextant, are clearly described and explained. Old and new navigation methods are cited and contrasted, and the final chapter presents a navigator's day at sea, upon a voyage planned from New York to Colon, with the application of variation and deviation, observations under varying conditions, and the estimation of currents. An abridgment of certain tables has been found necessary, but this has been intelligently accomplished, and more extended tables are mentioned in the text.

THE LITTLE FLAG ON MAIN STREET. By McLandburgh Wilson. New York: The Macmillan Company, 1917. 16mo.; 140 pp. Price, 50 cents.

This is the sort of semi-humorous verse, often rubbing elbows with both power and pathos, that gets under the skin and into the blood of the "common people" when high-flown phrases are deflected like raindrops from a duck's back. Moreover, there is pith and point and good workmanship here; there is the rhythm of marching hosts, the hues of the flag and the call of the bugle. These unpretentious songs should find an echo in the hearts of many readers.

EXPERIMENTAL GENERAL SCIENCE. By Willard Nelson Clute. Philadelphia: P. Blakiston's Son & Co., 1917. 12mo.; 318 pp.; 96 illustrations. Price, $1.25 net.

Both the texts and the teachers of courses in the special sciences are apt to take too much for granted that the students entering upon these courses are familiar with general laws and phenomena; also, many who enter high school have to leave before the completion of the course, and the advisability of their having some knowledge of general science is beyond question. The text in hand is designed to fill this need; it aims at awakening the interest of the student, providing him with a fund of useful information, preparing him intelligently to take up the special courses, and initiating him into the laboratory method of solving problems. The phenomena of matter as it is affected by energy are effectively arranged and presented; the text has been given a practical test extending over several years, and the author has had the advantage of much good advice and assistance.

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AND HOW TO KNOW IT

BY

ALBERT A. HOPKINS

Editor of the Scientific American Reference Book, Etc.
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FOREWORD BY HON. NEWTON D. BAKER
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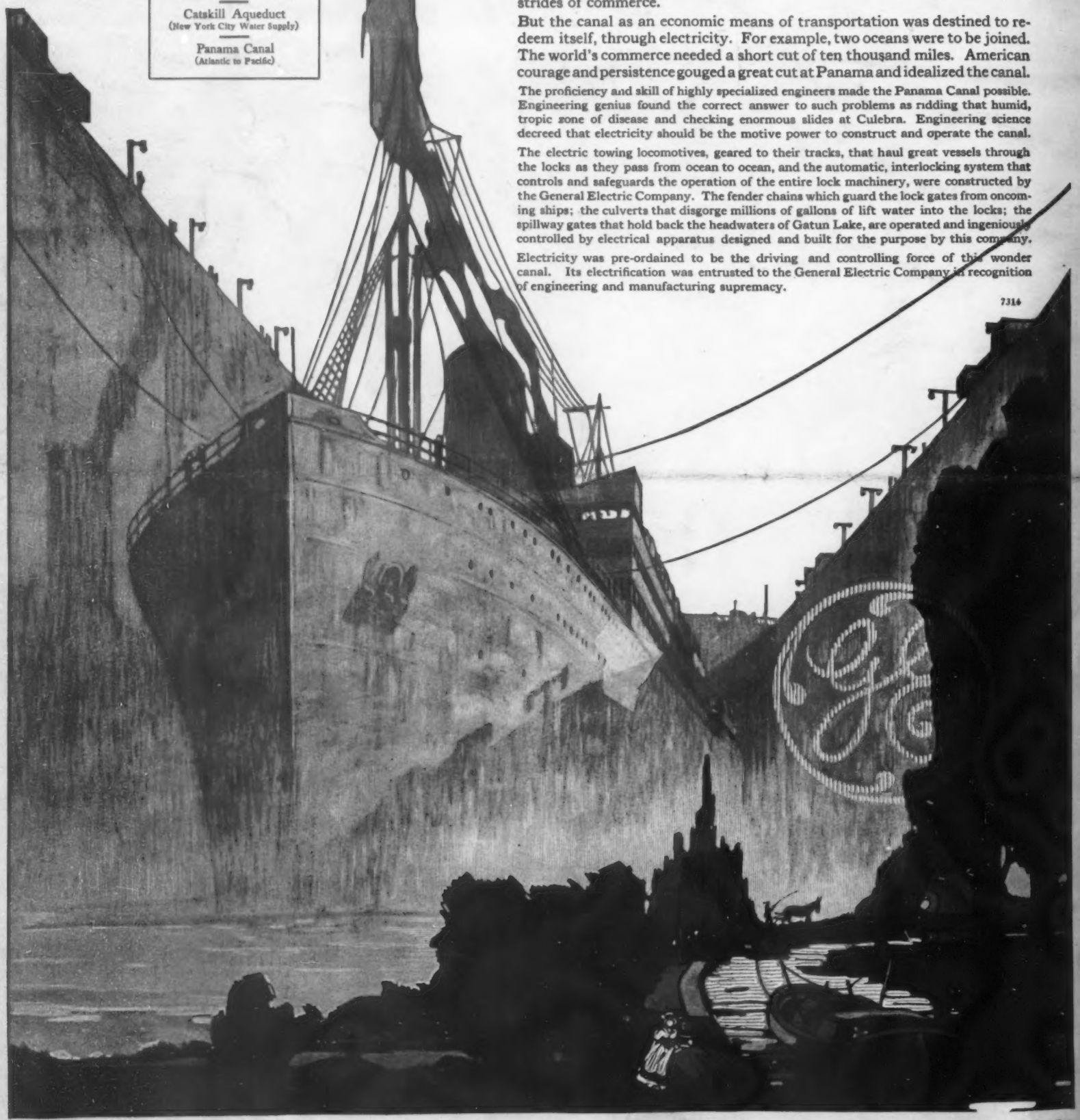

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February 2, 1918

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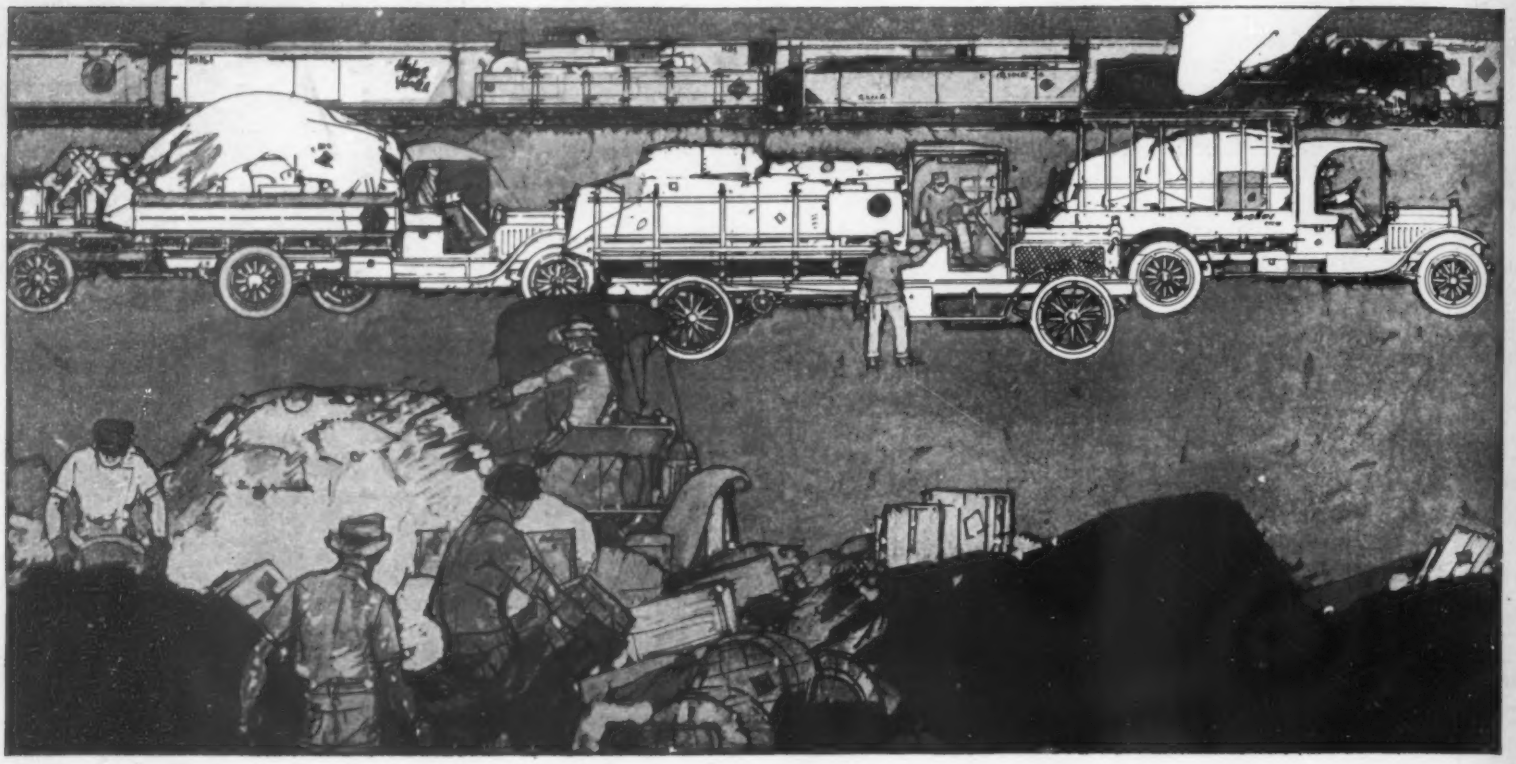

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